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PSYCHE

VOL. XXXVII JUNE, 1930 No. 2

ANT-TREE NOTES FROM RIO FRIO, COLOMBIA

BY W. M. WHEELER AND P. J. DARLINGTON, JR.

The observations recorded in the following pages on the various insects inhabiting Triplaris, Cecropia and Acacia trees in the vicinity of Rio Frio, Colombia, were made by the junior author during 1928-'29. The only contribution of the senior author is the identification of the ants which regularly inhabit the trunks and twigs of Triplaris and Cecropia and the large thorns of Acacia, and some data secured in 1927-'28 in the same locality by Dr. George Salt. It has been impossible to obtain accurate specific identifications of the plants, because they were not in bloom when the observations were made.

I. TRIPLARIS AND ITS INHABITANTS

Two forms of this tree were found, one (Plate 1, lower fig.) with narrow, lanceolate leaves and apparently the same as the *T. americana* Linné which has been studied by the senior author in Panama, the other (Plate 1, upper fig.) with broader, more ovate leaves and perhaps merely a variety of the preceding. The narrow-leaved form is a small, straight, slender tree somewhat resembling a hickory in general appearance. Near Rio Frio it is rather closely restricted to the edges of brooks in and near the foot-hills of the Sierra Nevada de Santa Marta. It usually grows so close to the brook that it can get water during the dry season, for it is one of the few trees of the lower foothills which is not deciduous. No specimens of it were seen above 1500 feet.

When the narrow-leaved Triplaris is inhabited by *Pseudomyrma triplarina*, it ranks with the terrible nettle (*Jatropha urens* L.) that grows in much the same sort of place. Both plants offer tempting holds on the steep slopes along the brooks, and a few stings from either the nettle or the ants will cause the hands to swell painfully. Ants and their brood occupy cavities in the central stem and its lateral branches throughout the Triplaris, except near the base of the larger trees. The cavities, which are continuous and are apparently cut through the nodes by the ants, may be occupied up to the last or next to the last internode below the terminal bud. The entrances are perpendicular slits in the stem or branches and are about 120° around the stem from the base of the leaf next above. They are usually just below a node, but may be more than half way down to the node below. There is almost always at least one entrance to a node, and there may be several, one above the other.

In very young stems the medullary cavity is about half the diameter of the stem, nearly round in cross-section, except for the depressions noted below, and somewhat enlarged between the nodes. The passage through each node is greatly constricted. In stems an inch and a half in diameter the entrance may remain open, but the cavity even in the oldest stems is scarcely or not at all larger than in young twigs. The walls of the cavities in the latter are brown; in old twigs, black.

The depressions mentioned above are vertical, slit-like grooves in the walls of the cavities and are of two kinds, those which open into entrances and those which extend only to the inner surface of the bark and are used to house Coccids. The position of the entrances has been described; the Coccid houses have a rather more irregular location, but often seem to be incompleted entrances, to which in many cases they correspond in position. They are frequently placed just below leaf attachments, however, where there is often a smooth, slightly depressed area on the external surface of the bark. Whether these "Coccid houses" are natural or cut by the ants was not ascertained.

The Colombian Triplaris and its ants had been previously observed by Forel, and Dr. Salt. We quote the latter's notes of October 16, 1927: "Quebrada Rodriguez, Rio Frio. A small tree of Triplaris sp. (*americana* ? according to Johansen) about 12-15 feet high and 2 inches at 5 feet above the ground, was felled and some of the ants collected. They sting viciously, the poison causing the fingers to swell and bringing out red flushes right up to the arm. The ant-brood and coccids were found in the branches and at the tip. In every case the coccids were found at the upper or distal end of the internode, frequently right up against the partition, and the ant-brood at the lower or proximal end. In several places on the inside of the hollow trunk the wood was deeply pitted but not perforated. It was not determined whether the pits were made by the ants or were normal depressions. The exit holes of the ants are regular in position and undoubtedly are merely modifications of some previously existing structures (lenticels?) of the plant."

The following insects were found by the junior author associated with the narrow-leaved Triplaris (Plate 1., lower fig.):

1. *Pseudomyrma triplarina* Weddel subsp. *symbiotica* Forel. Probably the commonest and certainly the most vicious ant in the Triplaris. It does not inhabit every tree, however, nor does it always take complete possession, for it was sometimes found sharing trees with No. 3. Series of this ant were also taken by Dr. Salt in Triplaris, presumably of the narrow-leaved form, at Rio Frio and Aracataca.

2. *Azteca theresiæ* Forel. A common species forming large colonies. It bites but does not sting and was found sharing trees with Nos. 1 and 3. The var. *menceps* Forel of this species is a very common tenant of *T. americana* in Panama, according to the senior author's observations.

3. *Crematogaster* (*Orthocrema*) *parabiotica* Forel. A small, inoffensive ant which often colonizes single branches of trees inhabited by one or both of the preceding species.

Apparently these three ants are all capable of maintaining their colonies without leaving the home tree. At any rate, this is true of the Pseudomyrma, for two of the Triplares were banded with tanglefoot and their foliage thus isolated on December 17, 1928. One tree was about four inches through at the base and twenty feet tall; the other about five-eighths of an inch by nine feet. At the time both were inhabited by pure Pseudomyrma colonies, which remained reasonably healthy till the middle of February, when the experiment was discontinued. The larger tree, however, may have lost a part of its Pseudomyrma population (this point was, of course, very difficult to determine) and certainly acquired a small colony of Crematogaster in the interval. Only one or two ants were caught in the tanglefoot and none was ever seen to attempt to reach the ground. The ants do *not* maintain a cleared area about the tree.

4. *Camponotus* (*Myrmocladœcus*) *bidens* Mayr. A few specimens of this small, timid ant were taken on a Triplaris with Crematogaster in March. *C. bidens* and its congeners are known to nest in hollow, dead twigs of a variety of trees.

5. *Trachysomus thomsoni* Auriv. (det. Fisher). This big cerambycid beetle fells the living Triplaris by gnawing a girdle around the bark and wood of the trunk. It attacks trees up to nearly three inches in diameter. The larvæ feed in the wood of the pruned trunks. Three adults, which were bred out, emerged in July and August, but the precise time of pruning was not ascertained.

Trees that have been killed attract a number of wood-boring Coleoptera, which are listed below. The order of their appearance was determined from a tree which was felled with a machete on December 17.

6. *Steirastoma stellio* Pasc. (det. Fisher). This is a cerambycid which was seen only during the first week after felling. Seven specimens were taken, all clinging to the lower side of the felled trunk, so the species is probably nocturnal.

7. *Odontocera* sp. nov. (being described by Fisher). This cerambycid, of the tribe Necydalini, appeared during

the first week after felling and continued to come for nearly a month. It bred abundantly in the Triplaris. The beetles are diurnal and may be seen hovering and dipping over the dead wood like Vespidæ. There is one vespid which they very much resemble and which sometimes occurs with them. The beetles were caught or bred out in January, March, May, June, July and December, so the species is probably multiple-brooded. Four specimens were taken in June near Santa Marta, on wood which was not Triplaris, but they may not have been breeding in it.

The two following species behave like this undescribed Odontocera, to which they are closely related. They were so scarce by comparison, however, that they furnished only scanty data.

8. *Odontocera fasciata* Ol. (det. Fisher). Eleven specimens were taken in January, May and December. Some were breeding with No. 7, some flying to dead Triplaris.

9. *Odontocera* sp. nov. (being described by Fisher). Five specimens were cut from dead Triplaris with No. 7 in May.

10. *Amphicerus cornutus* Pallas (det. Fisher). This large bostrychid beetle appeared on the dead Triplaris January 15, about a month after felling. The first specimens were cut from tunnels which entered the hard wood of the trunk at right angles, but curved around parallel to the grain at a depth of about half an inch. On February 17, two months after the tree was felled, five of these beetles were cut from the ramifications of a single tunnel system. The tunnels were, of course, made entirely by the adults and no sign of eggs or larvæ could be found. Two specimens were taken at Santa Marta in May, probably at light.

11. *Dendrobiella sericans* Lec. (det. Fisher). This small bostrychid was first noticed during the third week after the Triplaris was felled, when adults were boring into the dead trunk. The species was common.

12. *Scalidia* sp. (det. Fisher). This cucujid appeared with the small bostrychid (No. 11), on which it probably

preys. At any rate on January 11 one of the cucujids was seen trying to pull a bostrychid out of its gallery entrance by the declivity of the elytra.

13. *Chrysobothris viridiimpressa* C. & G. (det. Fisher). One specimen of this buprestid was taken in tanglefoot on a living Triplaris early in January. Two or three other individuals were seen, all on plants of other species, so the occurrence of the beetle on the ant-tree was probably accidental.

14. *Membracid,* sp. A small, simple species with spotted wings, of which both adult and immature individuals were collected at leaf axils on the Triplaris. The tree was inhabited partly by Azteca and partly by Crematogaster. Neither ant seemed to be paying any attention to the hoppers, however.

15. *Pseudococcus probrevipes* Morrison. These Coccids live with both the Pseudomyrma and the Azteca. They are usually found in the groove-like channels or pits which are mentioned on page 108, but they may occur at the sides of entrances or around the nodes, always, of course, inside the tree. They are often so crowded into their "houses" that, if feeding is possible only on the inner surface of the bark, they must take turns at it.

The broad-leaved Triplaris (Plate 1, upper fig.) is a smaller, more compact tree than the narrow-leaved form and grows in a different habitat, at the boundary of forest and new clearing far from water. It may perhaps be the same species modified by unfavorable conditions. The wood structure was not examined in detail but seemed to be the same as in the narrow-leaved form. The only ant taken in the broad-leaved Triplaris was *Pseudomyrma triplarina symbiotica,* but it is comparatively scarce and colonizes only a small proportion of the available plants. The following insects inhabit the twigs or live on the foliage:

16. *Thyridid,* sp. The greenish larvæ of this moth were found on April 7 in the medullary cavities of Triplaris which had *not* been colonized by ants. The same or a very

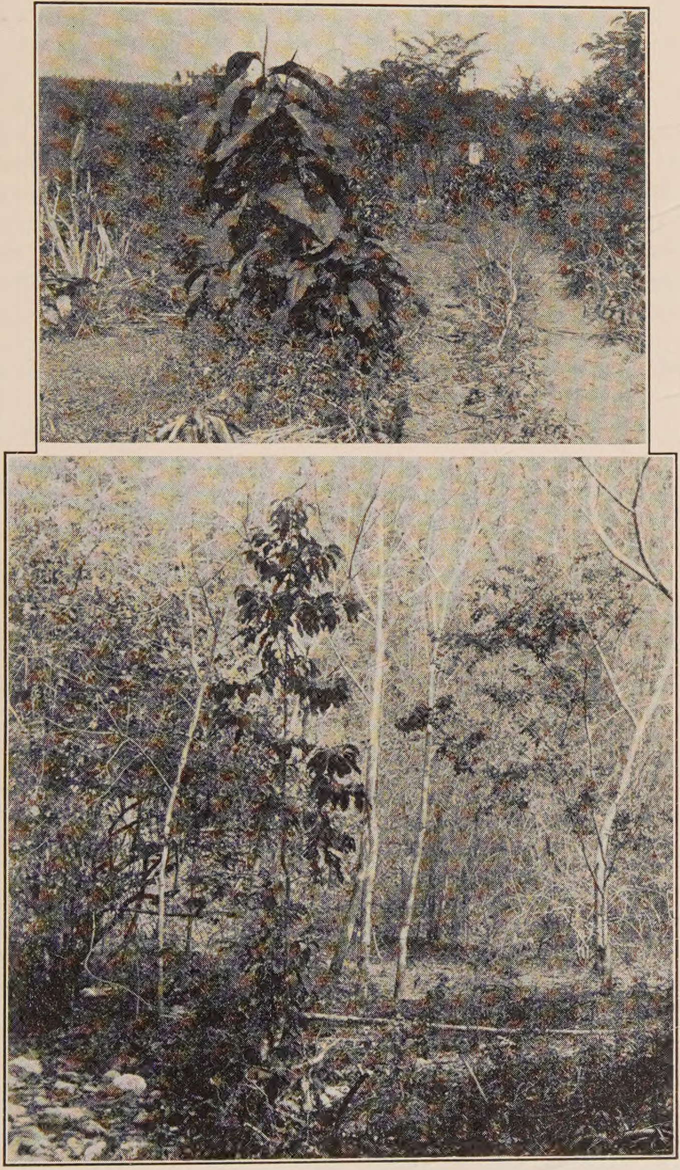

PLATE 6

Wheeler and Darlington—Ant-Tree Notes

similar larva has been frequently taken by the senior author in the twigs of *T. americana* in Panama.

17. *Cassidid,* sp. This beetle was brilliant green in life. It was common on Triplaris foliage in May. Other specimens were collected in March and November. When the beetles were taken no ants were visible on any of the trees, but this may have been because the latter were too young to have been colonized, or more probably because the colonies produced in the internodes by the recently fecundated females were still undeveloped.

18. Coccids undetermined. Although these may have been present in the ant-inhabited trees, they were taken only in the cavities which had not been colonized.

II. CECROPIA AND ITS INHABITANTS.

Cecropias, called locally "guarumo," are common trees in second-growth land and similar situations from sea-level up to at least 4500 feet. They are absent in the very arid regions, however. As has been noticed by other observers, they are among the first trees to come in when cultivated land is abandoned. Although the ants (*Azteca alfari* Emery) which inhabit the Cecropia bite severely, the tree is so conspicuous and easily avoided that it does not cause much trouble. The ants seem to get all the necessities of life from their trees. At any rate a well-colonized tree which was isolated by machete work and tanglefoot on December 15 seemed to have its population unreduced at least up to February 27. The peculiar structure of the plant has been so often described that it need not be considered in this place. The following insects were found associated with the Cecropias:

19. *Azteca alfari* Emery. Practically all the plants, except the very young ones, are inhabited by this ant.

20. **Azteca xanthochroa** Roger. subsp. **salti** Wheeler, subsp. nov. The worker minor measures 2.5 mm. and is

gaster, antennæ and legs deep castaneous brown, the head black, the mandibles and corners of the clypeus red. Pilosity shorter and less abundant, especially on the head. Antennal scapes extending a distance greater than their apical diameter beyond the posterior corners of the head.

The female (deälated) measures 10-12 mm. and has a longer and posteriorly narrower head than any of the more shining than the typical form of the species. Thorax, other forms of *xanthochroa,* with nearly straight sides, deeper excision of the posterior border and less convex eyes. Thorax and gaster somewhat darker, more reddish yellow; head, antennæ and femora red, clypeus and mandibles deep red. Hairs on the body and tibiæ blackish, long and abundant; appressed pubescence also long but yellowish.

Described from numerous workers and fifteen females, constituting small incipient colonies, taken by Dr. George Salt from the internodes of young Cecropias at Vista Nieve, Sierra Madre de Santa Marta, Colombia, at an altitude of 5000 feet.

21. *Cœlomera cayennensis* Fabr. In life this Chrysomelid beetle has bluish-black elytra and a reddish prothorax. It is very common on young plants, but *never,* in the experience of the junior author, on the older ones. The old plants often have the leaves stippled with minute holes, the origin of which was not discovered, but never have the marks of beetle feeding. Nor were any of the chrysomelids seen on Cecropias containing developed colonies of Azteca, but this may, of course, have been because the beetles preferred the young plants as food and not because they had been driven away from the older ones by the ants. Beetles were taken in January, February, May, June, July, November and December. They are, therefore, probably either multiple-brooded or always present.

During the rains, probably in May, the junior author feels reasonably certain that he saw large Scarabæids (apparently *Pelidnota* sp.) feeding on young Cecropias, but he did not know at the time that the plants were worth study.

22. Coccids. These were found in the cavities of the Cecropias with Azteca.

It is noteworthy that dead Cecropia logs failed to attract borers, although they were carefully examined at different times.

Birds were not seen to visit Triplaris, but the Cecropias were observed to be favorite feeding grounds of several species, particularly in November. Some of the species noted were:

Forpus spengeli (Hartlaub), a minute, green and blue parrot,

Brotogeris jugularis jugularis (Müller), a small green parrot,

Momotus momota subrufescens Sclater, the local motmot,

Pteroglossus torquatus nuchalis Cabanis, a toucan,

Centurus rubricapillus rubricapillus Cabanis, a common woodpecker,

Thraupis episcopus cana (Swainson), a common tanager. None of these birds was ever seen to act as if it had been attacked by the ants.

III. NOTE OF ACACIA.

Ant-inhabited acacias were found only near Aracataca, in the extreme southern part of the region over which the junior author collected. The largest plant examined was hardly more than ten feet high. Though he had no opportunity to study the relations of the ants to the plants in detail, he secured a number of the former from the large thorns. They prove to be specimens of *Pseudomyrma spinicola* Emery subsp. *gaigei* Forel. The types of this form were taken by Dr. F. M. Gaige at Fundacion, south of Santa Marta, probably from thorns of the same species of Acacia. The senior author has found a very similar form of *Ps. spinicola* in the thorns of *A. penonomensis* on the Pacific side of the Panamanian isthmus. The spines of the Colombian Acacia secured by the junior author resemble those of the Mexican *A. Hernandezi* Safford, but the plant is probably undescribed, because no bull-thorn acacias seem to have been recorded from Colombia.

DESCRIPTION OF PLATE 6

Above

Triplaris sp. ("Broad-leaved Triplaris"). A five-foot tree in characteristic habitat near Rio Frio.

Below

Triplaris sp., probably *T. americana* Linné ("Narrow-leaved Triplaris"). A twenty-five-foot tree in characteristic habitat near Rio Frio. The felled tree upon which wood-boring insects were collected lies across the foreground.

DESCRIPTIONS PLUS TYPES *VS.* DESCRIPTIONS ALONE.[1]

By Clarence E. Mickel,

University of Minnesota.

In a recent article in Psyche [36(3):228-231, September, 1929] entitled "Down with the Type-Cult," Professor Embrik Strand of the University of Riga, Latvia, condemns the practice of designating type specimens when a new species is described, charges that their use is contrary to the International Rules of Nomenclature, and urges the principle that the description should be the final and only authority in deciding disputed points regarding the identity of a species.

The principal arguments advanced by Professor Strand in his opposition to the use of types may be summarized as follows: (1) that the early authors such as Linné, Fabricius and others did not designate or use types, therefore we should not; (2) that the establishment of species on the basis of types is opposed to the rules of nomenclature; (3) that even if one asserts that the types have been used only in order to verify and better the descriptions, it is likewise an abuse, if it leads to conclusions that are quite contradictory to the descriptions; (4) that type specimens are the fashion because certain taxonomists by their use are able to dominate taxonomy, and therefore have a personal interest in maintaining the practice; (5) that in most cases the types are not accessible to the worker, that on this account it will soon be impossible to write a monograph if the examination of the types is to be considered a necessary prerequisite, and that therefore the practice of designating and using types should be abolished; (6) that the entomological public is obviously apt to place more confidence in the new "examiner" of the type than in the original describer, and that to protect the latter and do him justice the practice of designating and using types should no longer be tolerated; (7) that when a specialist or reviser secures a second party to compare his specimens with the type, swindles are often perpetrated on the entomological community, and therefore the practice of using types should be dispensed with; and finally (8) that the description is quite an absolutely constant, invariable thing which is accessible to the whole world, and is therefore everything, and in case of a disputed point with regard to the identity of a species the description should be the final and only standard or authority.

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It will be advantageous to consider these charges and arguments one by one and see how much basis in fact there is for maintaining them.

(1). The first point is that since early entomological workers did not use types, we should not; that since our forefathers did not do so-and-so, we should not; a sort of ancestor worship. If the work of the older authors be examined it will be found that they did not limit species as strictly as we do today; they did not realize the value of geographical, ecological and other precise data in taxonomic work, and consequently stated what data was available to them in exceedingly general terms. They could not foresee that the specimens of the species which they described would be of great value to future generations, and therefore paid little attention to them. Like certain workers of today they were so absorbed in writing descriptions of new species that this activity seemed to them to be the ultimate aim of taxonomy, and they therefore had no time for taking proper care of the specimens on which their work was based. Neither did they have any conception of the enormous number of species of insects that would eventually be found inhabiting the earth. If there were only ten, or a hundred, or a thousand, or even ten thousand species of insects known for the world the necessity for type specimens might not seem very obvious; but when the number of species rises to hundreds of thousands and possibly millions, then the need for some standard of reference for each species becomes very plain. So the older workers, who did not realize the enormous number of species of insects with which taxonomy would have to deal, had not come to feel the need of types, and to argue that since the older workers did not designate type specimens, we should not do so today, is to argue that the taxonomy of a hundred, or one hundred and fifty years ago is good enough for us, that progress and advancement in technique and analysis is undesirable in the field of taxonomic research. No taxonomist who is seriously interested in the improvement and advancement of taxonomic work would ever be tempted to adopt such a principle.

(2). The establishment of species on the basis of types is opposed to the rules of nomenclature. First it should be pointed out that the rules of nomenclature are not concerned with the establishment of species, but only with the names of species, subspecies, genera and other categories in use in the field of zoology. If by this statement Professor Strand means an attempt to establish a specific name on the basis of a museum specimen only, then he is quite correct and is supported in his contention by Opinion one, of the International Commission on Zoological Nomenclature, which states that in no case is the word "indication" to be construed as including museum specimens. If, however, he means that in an attempt to decide the identity of a species with a valid specific name, the use of, or designation of, a type specimen to solve the problem, is opposed to the International Rules, then he most certainly is incorrect, since the International Commission has ruled on that point in Opinion seventy-eight regarding the validity and identity of the names of two ticks. The validity of the names was decided on the basis of the first properly published description or indication, while the identity of each was decided on the basis of type specimens, which in both cases were designated some time after the first publication of the names.

(3). If the conclusion reached by using a type specimen to supplement a description is contradictory to the latter, then it is an abuse. To show the impossibility of using any such principle as a criterion as to whether the use of types is scientific or not, it is only necessary to call attention to the innumerable cases in entomological literature where a description of a new species has been drawn up based on a series of two or more specimens. Such a description is a composite one, including characters seen by the author in all of the specimens before him. In many such cases we know now, or at least the evidence available leads us to believe, that this series of specimens consists of more than one species. Therefore, the description includes characters of all the species represented in the series of specimens which the author had before him when he wrote the description. For the sake of simplicity we will suppose that two species were represented in such a series of specimens. If a single specimen from the original series of specimens is designated as the type, then the species which it represents will have some characters which are contradictory to the description, because the latter is composite. If a specimen of the second species represented in the original series is designated as the type the result will be the same; it will be contradictory to the description. Then one is at an impassé, if this principle is to be adopted; the description applies to neither of the two species, since whichever one is selected brings results contradictory to the description, and the only other recourse is to place the description in that zoological graveyard "*species incertæ sedis*," where it will remain forever. If the description is everything, and nothing but that is used, the result is the same, since no object in nature is to be found but what is contradictory to the description to some degree, and the name, therefore, finds its way into the list of "*species incertæ sedis*." The adoption of this principle then, i. e., that if a type is used to supplement a description, and the conclusion reached thereby is contradictory to the description, then the use of the type is an abuse, would only lead to more confusion, additional names for which we could find no objects in nature, and more inaccuracies in taxonomic work.

(4). It is implied that type specimens have come to be so widely used, not because they have added an element of certainty and exactness to taxonomic work, but because certain taxonomists by their use are able to dominate taxonomy, and therefore have a personal interest in maintaining a type system, that they secure for themselves either power or personal aggrandizement by the perpetuation and strengthening of such a system. Granting for the moment that such a motive were possible, would the situation be any worse than that which now exists and which allows an individual to acquire eminence and renown as a taxonomist, although he contribute nothing more to taxonomy than an endless number of descriptions of new species, to which his name must be attached. The idea that the describing of species may be a major objective in taxonomic work is seriously questioned by many present-day entomologists. Just what personal power and aggrandizement can be secured by an individual by basing his taxonomic work on type specimens is not made clear, and the charge that the practice of designating types for species is maintained by those who personally profit from the system, sounds strikingly similar to the charge usually made by the opposition, who refuse to see any good in any new idea, and who in order to encourage prejudice against it, accuse the proponents of promoting their own personal interests. As a matter of fact, type specimens were first used, and their use continues and is being perfected, because they have contributed an element of standardization to taxonomic work. A type specimen constitutes a standard by which other individuals of the same species may be measured and compared, and when so used it contributes accuracy and exactness to a field where doubt and confusion have been prevalent. When a nation desires some standard for a unit of weight, measure, etc., does it write up a lengthy description of the particular unit and declare that this description will be the only and final authority to determine what the unit actually is? It does not. Some sort of a material standard representing the particular unit is set up and is very carefully kept and preserved. When questions of doubt arise as to the exact characteristics of the unit, the standard is the ultimate and only source of comparison by which any particular characteristic of the unit may be determined.

(5). Kleine's (1928) complaint is cited to the effect that the types in most cases are not accessible to the worker and shortly it will be quite impossible to write a monograph if an examination of the types is to be considered a necessary prerequisite for such work. Under present conditions, with types scattered in various places, there can be little question but that the amount of work and expense necessary to produce a monograph of any group of organisms would be greatly reduced if the examination of type specimens could be dispensed with, and any scientific worker is certainly at liberty to write a monograph based on nothing more than the descriptions of the species involved. But the author of such a monograph must remember that the scientific world will judge his contribution by the accuracy and exactness which he has been able to achieve by his method of treatment. The scientific world has learned from sorrowful experience that monographic works based on nothing but published descriptions are so inaccurate and untrustworthy as to be practically valueless, and while monographs prepared according to that method may still be produced, they are not very likely to receive serious consideration. The very fact that taxonomists have come to realize that scientifically sound and accurate work cannot be produced when based solely on descriptions, is the motivating force that has driven them to use a type specimen as a standard when some disputed point is to be decided. The use of type specimens has enabled taxonomists to achieve results of greater scientific value than the use of descriptions alone, and as long as types continue to contribute such a quality to taxonomic work, just so long will they be used, regardless of additional work or expense.

(6). Another objection to the use of types raised by Professor Strand is as follows: "That the entomological public is obviously apt to place more confidence in the new examiner of the type, than in the original describer. Who guarantees that the new examiner of the type is abler than the original describer in this respect? I think that it has often happened that the reviser has degraded a number of species into synonyms because he did not see the distinctive marks which the original describer stated, and which in reality are present." The truth is that the entomological public has no more confidence in the reviser, or new examiner of the type, than it has in the original describer. The work of both must stand or fall on its merits. As a matter of fact the original describer is better protected against injustices if he designates a holotype, than he is if he refuses to acknowledge the usefulness of types and clings to the theory that the description is everything. A description may be so poor that it is indistinguishable from that of several related species and if the description was everything the species would then be relegated to synonymy; but if a holotype has been designated, a standard can be examined and the status of the disputed species determined in relation to other species of its group. For every species that has been relegated to synonymy unjustly due to an examination of a type, three or four can be cited which have been elevated from synonymy to validity due to the fact that a type specimen was available for examination, and three or four more could be cited which are probably valid species, but which have been placed in synonymy because they are indistinguishable from previously described species on the basis of the description, and either no type is available, or if available, has not been examined. The best guarantee which a taxonomist can secure against injustices in the estimation of his work is a properly designated holotype for every species described, said holotype deposited in an institution where all may see.

(7). The comparison of specimens with the type by persons other than the reviser or specialist is resorted to relatively few times in entomological taxonomic work. That is, comparing the number of types actually examined by the reviser, with the number examined by proxy, the latter will be found to be relatively small. Judging from my own experience, the safeguards set up by the reviser to prevent the second party from arriving at an erroneous conclusion when comparing certain specimens with the type, are ample to prevent errors in most cases. Such precautions also testify to the good faith of the reviser and indicate that he is seeking for the truth regardless of what it may be. If taxonomists as a class are so intellectually dishonest as to swindle the entomological public in this way, as Professor Strand claims, how much easier it would be to perpetrate such swindles if the description were everything. It happens rather often that the descriptions of two species are indistinguishable when compared word for word. In such a case the reviser would need to go no further; his report would be that here are two descriptions exactly alike and therefore one of them must be relegated to synonymy. If the descriptions were everything no one could challenge his conclusion, since there would be no source of evidence with which to support such a challenge. Species have been relegated to synonymy by this method many times in the past, with the result that when the types were finally located and authenticated it was found that the description referred to a good and valid species. Descriptions or types, either one, will not prevent intellectually dishonest persons from perpetrating swindles, nor will the use of either one tempt an honest man to use dishonest methods in his research. If Professor Strand knows of concrete examples of such swindles, as he claims, it is his duty to bring them to the attention of entomological taxonomists, together with the facts and evidence to prove that they are swindles. To point out concrete examples and expose them as swindles will do more to eliminate dishonest work from the field of entomological taxonomy, than assailing a method of technique and mode of thought which has improved the quality of taxonomic work.

(8). And finally it is contended that the description is quite an absolutely constant, invariable thing which is accessible to the whole world, while the question is asked: "Who guarantees that the animal designated as the 'type' really is the type"? The implication in the question is, that taxonomists as a group, in the field of entomology, at least, are so dishonest and unreliable that type specimens in general cannot be relied upon to be what they claim to be, i. e., the original specimens from which descriptions or figures have been drawn, and in many cases designated as type by the author himself. If this implication of dishonesty and unreliability were true, who could guarantee that any published description was applicable to any organism existing in nature? If a worker is dishonest enough to manipulate types or type labels, he is dishonest enough to write descriptions of species based on nothing more than fancies of his imagination, with no counterpart in nature whatever. To be dishonest with respect to scientific descriptions or type specimens is like cheating at solitaire—one is only cheating himself. It is true that rogues may be found in every field of human activity, but they are usually comparatively rare in scientific professions. With respect to honesty and reliability, I believe that taxonomists as a group will compare favorably with any other group of scientists, or with other selected professional groups, and the implication that type specimens in general are unreliable, due to the dishonesty of taxonomic workers, seems to me to be entirely unjustifiable.

The theory that the description is everything is one that is not universally tenable. Article twenty-five of the International Rules of Nomenclature states: "The valid name of a genus or species can be only that name under which it was first designated on the condition (a) that this name was published and accompanied by an indication, or a defition, or a description." Opinion one of the International Commission states: "The word '*indication*' in Article twenty-five-a is to be construed as follows: with regard to specific names, an 'indication' is (1) a bibliographic reference, or (2) a published figure (illustration), or (3) a definite citation of an earlier name for which a new name is proposed." In the case of two of these there is no description which can be everything. A bibliographic reference is a substitute for a description in validating a name. A published figure is either a substitute for a description, if the latter is lacking, or it is a supplement to the description in case the latter is present. If the description is everything and objection is made to the type because it is a supplement to the description and therefore erroneous conclusions may be drawn from it, then a published figure is in the same class as the type. It is a supplement to the description and conclusions drawn from it may be contradictory to the description. If the principle "the description is everything," were rigidly construed, type specimens, published figures, museum specimens, or any description subsequent to the original one could not be used in the preparation of a monograph. How far would taxonomy progress if such a principle were adhered to? We would then have a mass of innumerable dogmas (descriptions) of which every word must be literally believed as true, and which would be looked upon as the final and only source of information regarding natural science. Such a condition actually existed in science for hundreds of years. From 200 A. D. to 1543 A. D. the written words of Galen describing the anatomy of the human body were looked upon as the final and only authority in this field. Galen's descriptions were everything. If discrepancies were found between Galen's descriptions and a dissected human cadaver, the descriptions were right, the cadaver wrong. During the period that this type of thought prevailed the spirit of scientific research was absent in all fields of knowledge, and anatomy as a science was stagnant. It was only when Vesalius overthrew authority and resorted to the dissection of the human body itself that anatomy began to progress as a science. Since Vesalius' time descriptions have been a necessary and useful method of recording scientific knowledge, but they have not been the final and only authority in anatomy or in any of the other sciences. In taxonomy individual specimens of the various species of animals and plants are our only source of information, and to outlaw such specimens, or even one selected specimen, designated as the type or standard, and to substitute therefore a written description is to substitute dogma for science, to substitute authority for research, a folly of the worst sort.

SUGGESTIONS REGARDING THE USE OF TYPES

Two practices now exist in the preservation and use of type specimens which make the work of the taxonomist who attempts any sort of a monographic revision much too difficult and expensive. Inasmuch as careful, accurate, analytical, monographic work is more needed in entomological taxonomy today than ever before, the modification of these practices in such a way as to remove the difficulties would have the effect of encouraging that type of work. These two practices are: (1) the policy of never loaning types from public museums under any circumstances; and (2) the practice of individual taxonomists in retaining holotypes in their private collections.

When any taxonomist undertakes the study of any limited group of insects, he usually finds that the holotypes are scattered over the earth among various institutions and individuals. In order to examine these holotypes it is necessary under present conditions to expend large amounts of money and time traveling to and from all of these places in order to accomplish the work. It frequently happens that the individual has neither the funds nor the time at his disposal to undertake the study of the types, and the result is that he produces either a distinctly inferior piece of work than that of which he is capable, or he produces nothing at all. The types are indispensable and should be religiously preserved, but we surely ought to be able to find some way to modify the present practice in order to make it possible for a deserving taxonomist to study the holotypes concerned in his work without forcing him to incur impossible burdens of expense and time which are now necessary. No changes in the policy of handling types should be made without due consideration of all the possible consequences, but there must be some way in which these difficulties could be overcome. Possibly some system of interinstitutional loans might be devised whereby the necessary type material could be concentrated at some institution near the worker concerned, and the latter be allowed to work there under proper supervision. There may be other possibilities in the way of solutions of this problem, but it is a serious enough one to challenge the best thought of all concerned.

The practice of individual taxonomists in retaining types in their private collections is a distinct disadvantage to entomological taxonomy as a whole. In the first place it is an incentive to an individual for the mere describing of new species in order that he may gain the holotype for his own collection. If any incentives are allowed to exist in present-day matters to benefit entomological taxonomy as a whole, they should operate to discourage mere describing of new species, and encourage careful, monographic work. This the practice does not do. In the second place a holotype once designated and published, no longer rightfully belongs to the individual, but belongs to the whole entomological fraternity. This principle has been recognized with regard to the published description. The latter once published, belongs to entomological science and not to any individual. Any rights which the author may have had with regard to it are lost to him upon publication. This principle is much more true with regard to holotypes upon which descriptions are based. The holotypes are the standards with which other individuals of the same species may be compared. Standards, as such, belong to the entomological community as a whole and not to any individual. What nation would allow any individual for one moment to possess any standard of weight, measure, etc., as private property and exercise his rights of private property over it? Such standards are recognized as belonging to the community and are preserved by national governments as such.

The retention of holotypes in private collections then, should be discouraged, and individual workers should be encouraged, if not compelled to deposit holotypes in some one of the many existing institutional collections. Many of the petty disputes and personal enmities which have arisen, and will continue to arise, over the matter of access to holotypes in private collections would thereby be mostly eliminated. It is admitted that the original describer might occasionally have to visit the institution where his types were deposited, but this would be no greater hardship for him than for any other taxonomist working in the same field. All of the rights of the original describer would thereby be preserved, and the interest of the entomological community would be better served than at present.

CONCLUSIONS

1. A type specimen constitutes a standard by which other individuals of the same species may be measured and compared, and when so used it contributes accuracy and exactness to a field where doubt and confusion have been prevalent.

2. The argument that since early entomological workers did not use types, we should not, is not worthy of consideration by a scientific worker.

3. The establishment of the identity of species by means of type specimens is not opposed to the rules of nomenclature; on the contrary, the International Commission of Zoological Nomenclature has used this means of identifying species in rendering Opinion seventy-eight.

4. The principle that if a type is used to supplement a description and the conclusion reached thereby is contradictory to the description, then the use of the type is an abuse, is untenable, and would only lead to more confusion and more inaccuracies in taxonomic work.

5. Type specimens have come to be widely used and accepted in taxonomic work, because they add an element of certainty and exactness to such work, and not because certain taxonomists have a personal interest in maintaining the practice.

6. The use of type specimens has enabled taxonomists to achieve results of greater scientific value than the use of descriptions alone, and as long as types continue to contribute such a quality to taxonomic work, just so long will they be used, regardless of additional work or expense.

7. The best guarantee which a taxonomist can secure against injustices in the estimation of his work is a properly designated holotype for every species described, the holotype to be deposited in an institution where all may see.

8. The comparison of type material by proxy does not tend to promote intellectual dishonesty among taxonomic workers. The exposing of concrete cases of dishonesty will do more to eliminate it than to abandon the use of type specimens.

9. With respect to honesty and reliability taxonomists as a group, will compare favorably with any other selected professional group, and the implication that type specimens in general are unreliable, due to the dishonesty of taxonomic workers, is entirely unjustifiable.

10. To eliminate type specimens and make the description everything, would be to substitute dogma for science, to substitute authority for research, an intolerable alternative.

11. Some method should be devised by which type specimens would be made more accessible to taxonomic workers than they are at present.

12. The practice of individual taxonomists in retaining types in their private collections is a distinct disadvantage to entomological taxonomy as a whole and should be discouraged.

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NEW SPECIES OF THE GENUS XYSTICUS (ARACHNIDA).

By Elizabeth B. Bryant.

Museum of Comparative Zoölogy, Cambridge, Mass.

In a recent revision of the spiders in the genus Xysticus at the Museum of Comparative Zoölogy, five new species have been found. Two more have been figured, one for the first time and the other to show more definitely the striking features of the palpus.

Xysticus aprilinus sp. n. (Fig. 4).

♀ 5 mm. long, cephalothorax 2.5 mm. long, 2.5 mm. wide.

Cephalothorax light, with a broad, brown stripe each side of the median light stripe, marginal markings faint and lacking the terminal light spots; dark spot at end of thoracic groove missing; abdomen much shrunken, showing no markings but occasional dark dots; abdominal bristles long; legs light with a light brown stripe edged with faint irregular dark marks on all legs, faint broken band at end of femur IV; sternum, venter and under sides of legs light; spines, I tibia, 4-2, no lateral, metatarsus 5-4, 1 lateral. Cephalothorax as long as femur I. Head very broad; bristles at edge of clypeus long. Epigynum longer than broad, very dark, with a simple round cavity showing no septum.

1 ♀ Texas; El Paso, 5 April, Soltau coll., N. Banks Collection.

The two broad, brown stripes on the cephalothorax, the light, unspotted legs makes this distinct from any other species.

Xysticus coloradensis sp. n. (Figs. 1, 3, 7).

♂ 5.5 mm. long.

Cephalothorax light, mottled brown each side of the median light stripe, ending with two pairs of small, dark spots on each side surrounded by a clear, cream color; the median light stripe with scolloped edges and faint dark marks behind the eyes, the usual dark spot at the end of the thoracic groove very small; bristles at the edge of the clypeus long; abdomen light with many small irregular dark marks with no distinct pattern; abdominal bristles long; legs light with many dark spots, light stripe on anterior legs indistinct; spines, I femur, many long spines on upper surface, tibia 4-4, the two middle pairs longer than the diameter of the joint, 3 lateral, metatarsus, 4-4, longer than diameter of the joint, 4 lateral, tarsus less than one half the length of the metatarsus. Cephalothorax as long as I femur. Sternum, coxae and venter light with small dark dots.

Palpus. The upper process of the tibia, ending in a sharp point under the tutaculum; the middle process prolonged into a large knob, the end covered with small bristles, between the upper and middle process is a large bristle; the lower process light colored, extending over the palpal organ, twisted with a broad tip. On the upper side of the tarsus are three long bristles. The tutaculum prolonged into a sharp process covered with curved hairs. The upper apophysis of the palpal organ is reduced to a small rounded knob; the lower is prolonged into a sharp curved point which rests on the outer curve of the tube.

♀ 6 mm. long; cephalothorax 2.5 mm. long, 2.5 mm. wide.

The female has the same markings as the male; the scolloped edge of the light stripe is more pronounced. The abdomen is spotted and shows a faint serrate median light stripe. The legs are spotted and the light stripe faint, spines, I tibia, 4-3, the two outer middle ones as long as the diameter of the joint, no lateral; metatarsus, 3-3, 2 lateral. The tibia is very short, only once and a half the length of the patella. Cephalothorax longer than I femur. Sternum and venter light with scattered dark spots.

Epigynum is a simple round cavity showing no median septum.

1 ♂ holotype. Col., Fort Collins, N. Banks Collection.

2 ♀ cotypes Texas; El Paso, 5 April, Soltau coll., N. Banks Collection.

2 ♀ New Mex.; Las Vegas, N. Banks Collection.

1 ♀ Col.; Ft. Reynolds, Dr. Miller coll.

It is probable that the two females from Texas are the same species as the male, as they have the same scolloped edge of the median light stripe, the two pairs of lateral spots on the cephalothorax, and the small dark spot at the end of the thoracic groove, and the spotted abdomen.

Xysticus floridanus Banks (Figs. 2, 5).

Trans. Amer. ent. soc.; 1896, 23, p. 70.

♂ 3.2 mm. long.

Cephalothorax clear, yellow-brown with a V-shaped light mark extending from the posterior lateral eyes to end of thoracic groove; abdomen with a serrate median light mark, bordered by three pairs of irregular brown spots, sides light brown; legs, femur I and II yellow-brown, tibia, darker brown, metatarsus and tarsus yellowish; posterior legs pale without markings; sternum and venter pale. Cephalothorax shorter than femur I. Head very broad. Spines, I femur 3, tibia 4-4, long spines, no lateral, metatarsus, 3-3, the second and third very long, and no lateral.

Palpus. Tibia with the usual three processes; the upper, a pointed flattened lobe; the middle a broad plate-like projection, and the lower a slender curving hood. The palpal organ is very simple. The upper apophysis is missing and the lower is light colored and in the lateral view appears only as a slight swelling in the lower part of the palpus. The tutaculum is very small.

1 ♂ holotype. Fla.; Punta Forda. N. Banks Collection.

Xysticus fraternus Banks (Figs. 6, 8).

Journ. N. Y. ent. soc.; 1895, 3, p. 90.

Xysticus hamatus Keyserling, Verh. z. b. Ges. Wien, 1884, 34, p. 521, pl. 13, fig. 22 (name preoccupied by Thorell, 1875).

Xysticus hamatinus Banks, Bull. U. S. nat. mus., 1910, p. 48.

In his description, Keyserling fails to describe the palpus and the only figure given omits the most striking character. This, Mr. Banks described as "a long plate-like piece projecting straight across the bulb towards the top of the palpus." The lower of the two apophysis usually found in the center of the palpus is prolonged into a slender piece which extends obliquely across the center; the upper apophysis is reduced to a small darkened, obtuse point which lies under the upper end of this piece. The end of the tube is bent almost at right angles and is probably one of the dark hooks figured by Keyserling.

The tibia has the usual three processes, the upper, resting against the tarsus, under the tutaculum, the lower a broad flattened piece and the middle reduced to a very small projection between the two. The palpus is much larger than is usual in the genus.

The type of Keyserling is from Bee Spring, Ky. Mr. Bank's type is from Sea Cliff, N. Y. In the M.C.Z. collection it is found from Cohasset, Mass. (17 June, 1914, E. B. Bryant Coll.) south to Falls Church, Va., and west to Las Vegas, New Mexico.

Xysticus keyserlingi sp. n. (Figs. 9, 10).

♂ 4.2 mm. long.

The cephalothorax with sides mottled with brown, much darker at the posterior part, median pale stripe with brown markings to form lyre-shape mark, ending with inconspicuous dark spot at the end of the thoracic groove; abdomen with median spear-shape mark of brown, and three pairs of lateral brown marks; anterior sides almost white; legs mottled with brown, I and II with distinct brown stripe; spines I tibia, 4-4, metatarsus, 4-4, longer than diameter of joint, 2 lateral. Sternum, underside of legs and venter mottled with brown. Cephalothorax longer than I femur.

Palpus. Tibia with the usual three processes, the upper a flattened lobe ending in a distinct spine bent at right angle; the middle process lobed and the lower long, slender

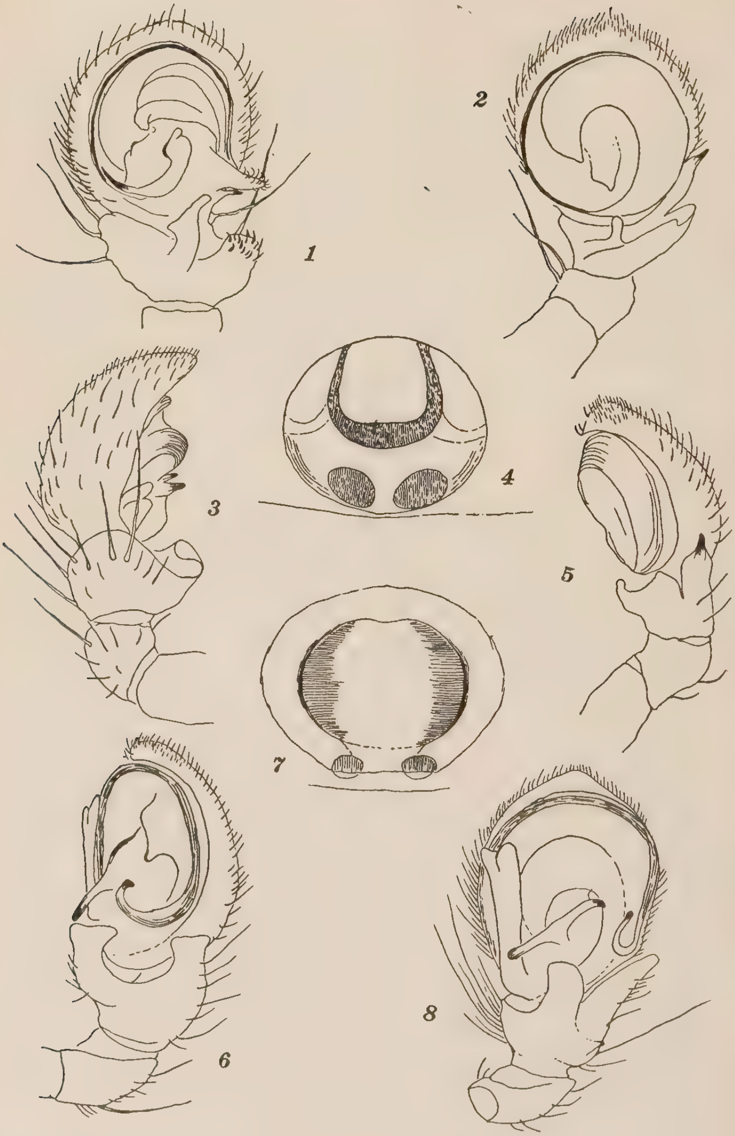
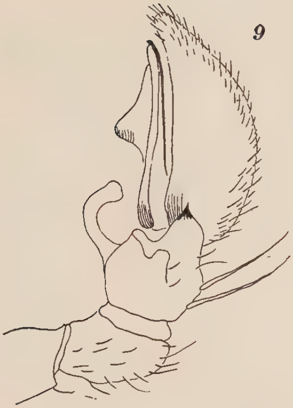


Plate 7

Bryant—Xysticus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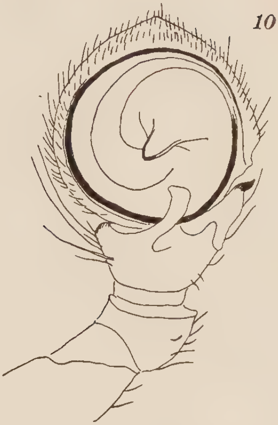
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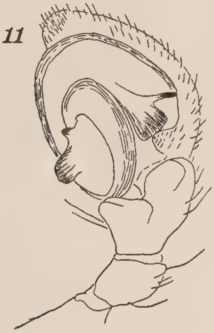
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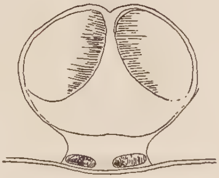
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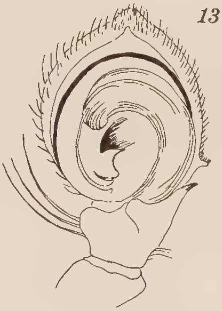
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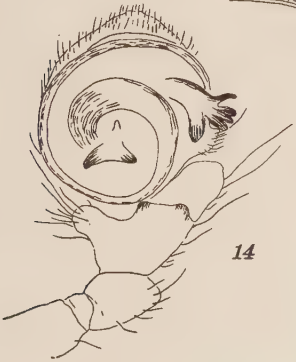
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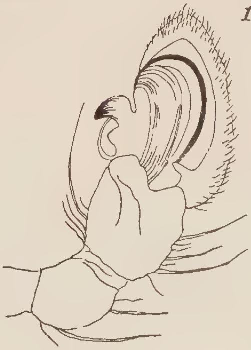
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PLATE 8

Bryant—Xysticus

and curving, two-thirds the length of the palpus. On the upper side of the tibia are two long bristles. The palpal organ is simple. The tube extends once and a half around the palpus. The lower apophysis is missing and the upper is white, spatulate with a thickened edge. The tutucalum is very small.

1 ♂ holotype. New Mexico; Las Vegas. N. Banks Collection.

Xysticus pallidus sp. n. (Figs. 11, 12, 14).

♂ 3.5 mm. long.

The cephalothorax pale mottled brown on each side ending in a darker brown spot, small dark spot at end of thoracic groove; abdominal marks characteristic of the genus, a central serrate light stripe, with four pairs of dark lateral marks. Anterior legs light with very small dark spots, with pale line on femur and tibia; posterior legs with larger, dark spots, and dark rings at end of femur IV and basal end of tibia. Few spines on femur I, tibia 4-4, longer than diameter of joint, 2 lateral, metatarsus, 4-4, longer than diameter of joint, 2 lateral, tarsus more than half the length of metatarsus. The cephalothorax as long as femur I.

The palpus is large. The tibia has the usual three processes, the upper large and broad, the middle broad and short and the lower a rounded knob with many long hairs. The tube of the palpal organ is bent at the tip at right angles as in *X. stomachosus*, and is supported by a lobed process. The upper apophysis is reduced to a small point and the lower is bilobed.

♀ 4.5 mm. long.

Cephalothorax pale brown on each side, with two pairs of darker brown spots; posterior part white, small dark spot at end of thoracic groove; abdomen lighter than cephalothorax without distinct marks. Anterior legs light and covered with many fine spots, the light stripe distinct on upper side of femur, patella and tibia; posterior legs pale with a distinct dark spot on the femur and a broken band at the distal end, patella with a dark spot at the tip, tibia with dark spot, near and one at the tip; spines of legs, I tibia 4-3, no lateral, metatarsus, 4-4, 2 lateral; sternum light with many small dark dots. Cephalothorax longer than I femur.

The epigynum is large and dark.

1 ♂ holotype, 1 ♀ allotype; Mass.; Ipswich on beach, 14 June, 1914. E. B. Bryant Collection.

This pair was found with the cocoon at the head of the beach under trash. It was first identified as a small *X. stomachosus* but closer examination shows that it is a different species. In *X. stomachosus* the spins on tibia I are 7-5, metatarsus 5-5. And the palpus and epigynum are quite different.

Xysticus vernalis sp. n. (Figs. 13, 15).

♂ 3.5 mm.

Cephalothorax dark mottled brown, with a broad median light stripe shaded with light brown at the anterior end, and a distinct dark spot at the end of the thoracic groove; abdomen with the characteristic markings of the genus, a pair of oblique lateral marks at the basal end and three pairs of transverse marks, connected by a median spot; sternum and venter light with many dark spots; legs brown, showing a light line bordered with dark on femur; patella and tibia; tibia and metatarsus lighter than femur; anterior tarsi light; spines, I few scattered on upper side of femur, tibia 4-4, two middle pair longer than diameter of joint, 3 lateral, metatarsus, 3-3, the two middle pair longer than diameter of the joint, 2 lateral. Cephalothorax as long as femur I.

Palpus. The upper process of tibia ends in a short, obtuse recurved spine, the middle process a blunt spatulate lobe and the lower process an inconspicuous knob bearing three long bristles. Three long bristles on the inner side of the tibia. In the palpal organ the upper apophysis is large, dark and bent downward, the lower is slender, dark and pointed, the two are separated by a clear white spatulate lobe. Below the lower process is a long slender filament lighter in color than the two median, which extends up and reaches the beginning of the bulb. The tutaculum is small and is edged with short curved hairs.

1 ♂ holotype, Mass.; Petersham 27-31 May, 1913. E. B. Bryant Collection.

Cotypes:

1 ♂ N. S.; Cape Breton, N. Sydney, July, 1906. E. B. Bryant Collection.

1 ♂ Me.; Portland Harbor, Long Is., June, 1901. E. B. Bryant Collection.

3 ♂ N. H.; Mt. Washington. N. Banks Collection.

1 ♂ Mass.; Holliston, 22 June, 1924. J. H. Emerton coll.

1 ♂ N. Y.; Sea Cliff. N. Banks Collection.

1 ♂ Ala.; Auburn. N. Banks Collection.

1 ♂ Ill.; Chicago. N. Banks Collection.

1 ♂ Iowa; Ames. N. Banks Collection.

EXPLANATION OF PLATES

Plate 7.

Fig. 1. X. *coloradensis* sp. n., ventral view of palpus.
Fig. 2. X. *floridanus* Banks, ventral view of palpus.
Fig. 3. X. *coloradensis* sp. n., lateral view of palpus.
Fig. 4. X. *aprilinus* sp. n., epigynum.
Fig. 5. X. *floridanus* Banks, lateral view of palpus.
Fig. 6. X. *fraternus* Banks, lateral view of palpus.
Fig. 7. X. *coloradensis* sp. n., epigynum.
Fig. 8. X. *fraternus* Banks, ventral view of palpus.

Plate 8.

Fig. 9. X. *keyserlingi* sp. n.. lateral view of palpus.
Fig. 10. X. *keyserlingi* sp. n., ventral view of palpus.
Fig. 11. X. *pallidus* sp. n., lateral view of palpus.
Fig. 12. X. *pallidus* sp. n., epigynum.
Fig. 13. X. *vernalis* sp. n., ventral view of palpus.
Fig. 14. X. *pallidus* sp. n., ventral view of palpus.
Fig. 15. X. *vernalis* sp. n., lateral view of palpus.

AUSTRALIAN BEES IN THE MUSEUM OF COMPARATIVE ZOOLOGY.

By T. D. A. Cockerell

University of Colorado, Boulder, Colo.

Having undertaken to prepare a manual of Australian bees for the Royal Zoölogical Society of New South Wales, I have been obliged to examine the undetermined material existing in various museums, in America and Australia. This task proves heavier than was anticipated, owing to the large number of specimens and species submitted. The Australian bee-fauna is extremely rich, as might be expected from the nature of the flora, and when I have done the best I can, there will still remain hundreds of species to be discovered and described.

Apis mellifera ligustica Spinola

Babinda, April 8; Halifax, June 1. Collected by F. X. Williams. Not native in Australia. In the Australasian Beekeeper, XXVII, Oct. 15, 1925, p. 68, Mr. T. Raymend published a supposed native Australian species, *A. ænigmaticus* (on p. 69 called *A. trigona*), said to occur in Victoria and S. Australia. Apparently no specimens are extant, and nothing is known except the comb.

Lestis bombylans (Fabr.)

2 ♀, Cooktown, Queensland (*E. A. C. Olive*).

Mesotrichia bryorum (Fabr.)

2 ♀, Halifax, July 11 (*Williams*).

Crocisa lamprosoma Boisduval

Halifax, June (*Williams*).

Crocisa omissa Cockerell

Seven from Halifax, May 9—June 20 (*Williams*). 1 ♀ Sydney, Feb. 28 (*Williams*).

Crocisa rotundata Friese

One from Melbourne (*Hy. Edwards*).

Anthophora cingulata (Fabr.)

♀, Halifax (*Williams*); ♀, Cairns (*Williams*); ♂, "Palm Island to Cooktown" (*A. G. Mayer*) *A. emendata* Sm. is a synonym.

Anthophora chlorocyanea Cockerell

1 ♂, 1 ♀, S. Australia (*H. Edwards*). In the female the scape is all black; in the male none of the ventral segments is emarginate, but the scape has a light mark.

Anthophora zonata (L.)

In 1921 I treated the common variable species of Queensland as *A. pulchra* Sm., which is its name if separated from *A. zonata;* but it now seems impracticable to recognize two species. In the males the face may be light yellow or white. 4 ♀, 4 ♂, Halifax (*Williams*); 2 ♀, 1 ♂, Mossman (*Williams*); 1 ♀, 2 ♂, Babinda (*Williams*).

Anthophora salteri Cockerell

1 ♀, with light face-markings white. Sydney, N. S. W., Feb. 28—March 8, 1919 (*Williams*).

Hyleoides concinnus (Fabr.)

Sydney, N. S. W. (*Williams*).

Coelioxys albolineata Cockerell

3 ♀, Halifax, and 1 ♀, Cairns (*Williams*).

Coelioxys albolineata var. *darwiniensis* Cockerell

1 ♀, Halifax, June (*Williams*). The femora are bright red.

Megachile mystacea (Fabr.)

3 ♀, 2 ♂, Halifax (*Williams*); 1 ♀, Brisbane, March 24 (*Williams*).

Megachile ustulatiformis Cockerell

2 ♂, Halifax, June 1-17, and June 20-July 9. (*Williams*).

Megachile hilli Cockerell

2 ♀, Halifax, June 1-17 and July 11-20 (*Williams*). When describing *M. hilli,* I wrote: "I had to consider whether this could be the female of *M. ustulatiformis,* and, while this is possible, it appears improbable." The present specimens, collected in the same locality, lend support to the view that these are sexes of one species.

Megachile pictiventris Smith[1]

1 ♀, Babinda, April 18 (*Williams*).

Megachile cincturata Cockerell

2 ♀, Cairns, April 1-12 (*Williams*).

Megachile ignescens Cockerell

1 ♀, Halifax, June 1-17 (*Williams*). This had been labelled *pictiventris,* but is easily separated by the abdominal hair-bands.

Megachile lucidiventris Smith

1 ♀, Sydney, N. S. W. (*Williams*). This is very like *M. suppresipennis* Ckll., but easily separated by the denticulate lower margin of clypeus.

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[1] Reviewing my material of *M. pictiventris,* I find I have confused with it a different ♀, taken by Turner at Mackay, Queensland, in January, 1900. It is distinctly more robust, and the beautifully metallic (green and purple) abdomen has white hair-bands, weak or failing in middle. The light hair of face is white (not at all yellowish), and the abdomen, seen from above, shows no outstanding black hairs toward the apex; characters which separate it at once from *M. igenescens.* This beautiful species may be called *Megachile rowlandi* n. sp., after Rowland Turner.

Megachile viridinitens n. sp.

♀. Length about or nearly 15 mm.; a parallel-sided black species, metathorax and base of abdomen densely covered with white hair, ventral scape entirely black, hair of legs black, wings dark fuscous except basally. The appearance is exactly that of *M. fumipennis* Smith, and I had hastily assumed it to be identical until I noticed the following differences: middle of lower margin of clypeus with two little shining tubercles; hair of face entirely black; no white hair on prothorax (except fringing tubercles) and no converging lines of white hair on anterior part of mesothorax; mesothorax finely punctured, the posterior middle minutely rugosopunctate; abdominal segments 1 to 4 strongly green, the callosities sublaterally shining, with sparse, strong punctures. Cairns, Queensland (*W. M. Wheeler*).

Megachile chrysopyga Smith

1 ♂, 3 ♀, Sydney, N. S. W. (*Williams*); Melbourne (*H. Edwards*).

Megachile quinquelineata Cockerell

Mr. F. X. Williams took females at Halifax, July 11-20; Cairns, April 1-12; Babinda, April 18; Mossman, April 24.

Megachile ciliatipes Cockerell

Mr. Williams took males at Halifax, July 11, and Babinda, April 16 and 18. It seems very likely that this is the male of *M. quinquelineata*, but I find that it is practically identical with the male of *Androgynella detersa* (Ckll.). The female *A. detersa* has no ventral scape; it cannot be a mutant from *M. quinquelineata* directly, because the last tergite is covered with pale hair, whereas in *M. quinquelineata* this is not the case.

Megachile gilbertiella Cockerell

1 ♀, Halifax, July 11-20 (*Williams*). This specimen has the red of fifth tergite confined to the apical margin.

Megachile rhodogastra Cockerell

♂. Length about 10 mm.; black, parallel-sided, rather robust; face with much creamy-white hair, cheeks with long pure white hair; antennæ long, black, the flagellum very faintly reddish beneath; mandibles black; clypeus very densely punctured, without a smooth line; mesothorax dullish, extremely densely and finely punctured; scutellum closely punctured; hair of thorax white, but some black on scutellum, as also on vertex; tegulæ very dark rufous; wings brownish, especially stained along the veins; first recurrent nervure twice as remote from base of second cubital cell as second from apex; legs black, tibiæ swollen, anterior coxæ not spined, anterior tarsi simple, middle tarsi with long grey hair behind, hind tarsi with very bright red hair on inner side; apical part of abdomen with tegument red.

3 ♂, Halifax, May 9-15, and June 1-17 (*Williams*). The above descriptive notes are from one of the specimens which seemed to be different, having the hind tarsi with bright ferruginous hair, and lacking the thick black fringe posteriorly. After close study, I conclude that there is only one variable species, but the matter deserves further study in the field.

Megachile cetera Cockerell

1 ♀, Halifax, June (*Williams*).

Nomia tomentifera Friese

8 ♀, 1 ♂, Babinda, April 8-16 (*Williams*); 1 ♀, Kuranda, April 16 (*Williams*).

Nomia darwinorum Cockerell

6 ♂, 2 ♀, Halifax, May 9-15, June 1-17 (*Williams*); 2 ♀, Babinda, April 18 (*Williams*). This is precisely *N. darwinorum,* described from the male, collected by Turner at Port Darwin. The female agrees with the earlier described *N. rubroviridis* Ckll., from the northwest coast, except that the flagellum is variably reddened beneath, and the hair of the apical tergites is very dark fuscous, not

ochreous. I think *N. darwinorum* is surely not more than a race of *N. rubroviridis,* but it is desirable to see the male of the latter.

Nomia halictella Cockerell

1 ♀, Mossman, April 24 (*Williams*); 1 ♀, Cairns, May 18 (*Williams*).

Nomia triangularis (Cockerell)

11 ♀, 2 ♂, Halifax, May and June (*Williams*); 1 ♀, Babinda, April 18 (*Williams*). The male was described by me as *N. pseudoceratina.* I described the female in 1905 as *Nomia halictella* var. *triangularis;* in addition to the differences cited, may be mentioned the darker tegulæ and tarsi. I feel sure I now have the sexes correctly associated, and it is evident that the species is quite distinct from *N. halictella.*

Nomia australica Smith

1 ♀, Melbourne (*H. Edwards*), has both clypeus and scape black. 1 ♂, S. Australia (*H. Edwards*), has scape clear red, black at end, but another with same data has the scape darker only faintly reddened. 3 ♂, Melbourne (*H. Edwards*).

Nomia frenchi Cockerell

1 ♂, Melbourne (*H. Edwards*); 2 ♂, S. Australia (*H. Edwards*).

Nomia gilberti Cockerell

1 ♀, Halifax, June or July (*Williams*).

Nomia flavoviridis Cockerell

1 ♂, Halifax, June; 40 ♂, 4 ♀, Babinda, April. All taken by Williams.

Nomia williamsi n. sp.

♂. Length about 7.3 mm., anterior wing 5.4 mm.; black with white hair; mandibles dark rufous apically, face rather broad, densely covered with white hair; scape entirely black (in *N. argentifrons* Sm. it is rufotestaceous in front); flagellum long, reaching scutellum, black above, dull red beneath; mesothorax and scutellum closely punctured; postscutellum with dense white (not at all fulvous) tomentum; area of metathorax broadly triangular, densely rugosoplicate, dull; sides of metathorax dull, except a broad shining band just below sides of area; mesopleura dull, anteriorly with white tomentum; tegulæ clear testaceous; wings hyaline, the apical region faintly clouded; stigma large, light orange fulvous, nervures pale testaceous; legs reddish black, with the knees bright ferruginous, tibiæ red at extreme apex, tarsi pale reddish, the basitarsi more whitish; hind legs not modified; abdomen moderately shining, hind margins of first two tergites reddened; apices of segments with rather narrow bands of dense white hair, broadly interrupted on first two; venter simple, except for a large patch of pale fulvous-tinted tomentum.

Halifax, June 1-17, 1919 (*F. X. Williams*). Very close to *N. halictella* Ckll., but smaller, with white instead of fulvous hair, and darker flagellum.

Nomia babindensis n. sp.

♀. Length about 6 mm., anterior wing 4.4; robust, indigo blue, the abdomen mainly black, but blue on first tergite and in the apical depressions of the others, second tergite with a shining brown hind margin. Head broad, face with very thin dull white hair, vertex with very long erect black hair; mandibles rufescent at apex; clypeus shining, broadly black apically, bigiblous, with a median depression; supraclypeal area with a shining median pale, slightly pinkish, band; front dull; antennæ dark; a little black hair on scutellum, but thorax above very bare; mesothorax dullish, minutely punctured; scutellum weakly bigibbous; area of metathorax short, dull, very finely sculptured; mesopleura shining blue in middle; tegulæ very dark brown; wings greyish hyaline, stigma small, dark brown; second cubital cell nearly square; first recurrent nervure meeting second intercubitus; legs brownish black, with pale hair; hind margins of tergites with short pale hair, not forming conspicuous bands.

Babinda, Queensland, April 8-16, 1919 (*Williams*). Readily known among the metallic species by the small size and blue color, with dark tegulæ and mainly black abdomen.

Meroglossa chiropterina n. sp.

♀. Length about 7.5 mm.; robust, black, with the light markings of head and thorax bright chrome yellow, consisting of face, and broad lateral marks going nearly up to level of end of scape, tubercles and quadrate spot behind, axillæ, scutellum and postscutellum; clypeus with a shield-like elevation, much longer than broad, the sulcus on each side of it black; supraclypeal mark a narrow triangle in middle of supraclypeal area, or it may be absent, and the clypeal yellow may be strongly notched above in middle; mandibles, molar space and cheeks black; scape swollen, ferruginous, black above at apex; flagellum black above, light ferruginous beneath; mesothorax dull and very densely punctured; tegulæ black; wings hyaline, with dull ferruginous stigma and nervures; first recurrent nervure meeting first intercubitus; legs black; abdomen black, simple, closely punctured.

3 ♂, Halifax, June 1-17, 1919 (*Williams*). In structure more like *M. eucalypti* Ckll., but by the black abdomen more like *M. sculptissima* Ckll. These bees belong to the subgenus *Meroglossula* Perkins. The specific name is derived from the resemblance of the face to that of a bat.

Palæorhiza disrupta (Cockerell)

Five from Babinda, April 16; one from Halifax, May 9-15; all collected by Williams. The Babinda specimens vary in the markings of the postscutellum which may be all green, to yellow with a green central band.

Hylæus alcyoneus robustus Cockerell

Two males from Sydney (*Williams*). One of these is intermediate between the type and var. *robustus*, having the ventral processes small.

Hylæus cyaneomicans (Cockerell)

Females were collected by Williams as follows: 2, Babinda, April 18; 1, Cairns, May 18; 18, Halifax, June, July.

Hylæus rotundiceps (Smith)

♀, Sydney (*Williams*).

Hylæus frederici (Cockerell)

♀, Southerland, N. S. W., Nov. 14 (*W. M. Wheeler*).

Hylæus eburniellus (Cockerell)

♀, Sydney, Feb.—March (*Williams*).

Hylæus brevior (Cockerell)

A male from Sydney, Feb. 28—March 8 (*Williams*).

Euryglossina perpusilla (Cockerell)

Two from Sydney, Feb. 28—Mch. 8 (*Williams*).

Euryglossina chalcosoma (Cockerell)

One from Sydney, Feb. 28—Mch. 8 (*Williams*) has the mesothorax strongly suffused with purple, but certainly belongs to this species.

Trigona carbonaria Smith

Fourteen from Halifax, six from Babinda, one from Cairns, and one from "Cordelia Hill, 600 ft., Halifax," all collected by Williams. These Queensland specimens mostly have the flagellum clear red beneath, but do not have the black hair scutellum which characterizes subsp. *hockingsi* Ckll., from the Cape York Peninsula.

Allodape simillima Smith

Eight from Halifax; June 17 (*Williams*).

Exoneura bicolor Smith

♀, Melbourne (*H. Edwards*).

Exoneura hamulata Cockerell

Females of this variable species from Australia (*H. Edwards*), Hornsby, N. S. W. (*Wheeler*) and Melbourne (*H. Edwards*).

Binghamiella antipodes (Smith)

4 ♀, 4 ♂, Sydney (*Williams*). 1 ♀, Melbourne (*H. Edwards*). For an interesting discussion of this species, see Raymend, Victorian Naturalist, Jan., 1929, p. 240, and a plate showing the structural features.

Paracolletes flavomaculatus Cockerell

Two females, Kuranda, Queensland (*Wheeler*).

Paracolletes fimbriatinus Cockerell

Male, Melbourne (*H. Edwards*).

Paracolletes semipurpureus (Cockerell)

♀, Southerland, N. S. W., Nov., 1914 (*Wheeler*). The color of the abdomen varies; in this specimen it is yellowish green.

Paracolletes hackeri Cockerell

♀, Sydney, Feb. 28—March 28 (*Williams*).

Paracolletes carinatus (Smith)

♀, Southerland, N. S. W., Nov., 1914 (*Wheeler*).

Paracolletes carinatulus Cockerell

♂, Halifax, June, and Sydney, Feb. 28—March 8 (*Williams*). These differ from the type in having the head and thorax bluish-green, the scutellum and metathorax quite blue. Noteworthy characters for the species are the polished green clypeus, dark antennæ (slightly reddened apically), pale thoracic pubescence and mainly red legs.

Sphecodes profugus Cockerell

3 ♀, 4 ♂, Halifax, May and June, one male as late as July 11-20; 1 ♀, Cairns, April. All collected by Williams. The male has the antennal segments strongly nodose; the abdomen has the first three segments red, the others black.

Nomioides perditellus Cockerell

1 ♂, Babinda, April 18. (*Williams*).

Parasphecodes arciferus Cockerell

2 ♂, Melbourne (*H. Edwards*). This sex is new; it has the ventral tubercle on abdomen just as in the female. Clypeus with a central pit, and with its apical portion very broadly dull yellow, this color extending upward in median line as a pointed projection. Antennæ long, reaching base of metathorax, black. First three abdominal segments dark chestnut red, the others black. Legs black.

Halictus urbanus Smith

♀, Sydney, Feb. 28—March 8 (*Williams*).

Halictus murrayi Cockerell

♀. Small (anterior wing 3.4 mm.), or rather larger; thorax usually purple blue, varying to blue-green; tegulæ refous; legs black; abdomen shining black; area of metathorax more or less distinctly plicatulate. This is not *H. urbanus* var. *stradbrokensis* Ckll., which is larger, with dark tegulæ, and area of metathorax regulose, not plicate. *H. urbanus* is a puzzling species, running into a number of local races, and *H. murrayi* is certainly very closely allied.

Queensland; 10 ♀ from Babinda, April 8-16, 1919 (*Williams*); and one from Halifax, June 17 (*Williams*). *H. murrayi* was described from the Northern Territory: it now appears more widely distributed and variable than was supposed.

Halictus subcarus n. sp.

♀. Length about 5 mm., anterior wing about 3.5; head rather broad, dark green with fine white pubescence on face and front; mandibles red except at base; clypeus shining, the apical half black, with a few very large punctures; supraclypeal area and front dull; flagellum bright ferruginous beneath; mesothorax and scutellum bright prussian green, the former dull, the latter more shining, but not polished; metathorax dark green, the basal area with short but strong plicæ, the margin of the area thickened, obtuse, blackish; pleura dark green; tegulæ clear fulvous; wings hyaline, stigma dark reddish, nervures pale reddish, outer recurrent and intercubitus colorless and almost obsolete; second cubital cell higher than broad; femora black, with knees red; tibiæ and tarsi bright ferruginous; hind spur with two large long spines; abdomen olive green, with fine pale pubescence, hind margins of tergites reddened; venter with much white hair. Under the microscope, the mesothorax is seen to be minutely tessellate and finely punctured, and the front below the ocelli is longitudinally striate. The face is conspicuously narrower than in *H. williamsi*, and the clypeus is more produced. It is easily known from *H. floralis* Sm. by the dull scutellum.

3 ♀, Halifax, Queensland (*Williams*). The type July 11-20, 1915; two others June 20—July 9, 1919. From *H. pavonellus* Ckll. it is known by the larger head, with more produced clypeus, green mesothorax and clear red hind tibiæ.

Halictus williamsi n. sp.

♀. Length about 5.5 mm., anterior wing about 3.7; head broad, round seen from in front, very dark green, with thin hoary pubescence on face and front; mandibles bright red apically; clypeus dull, with very dense lineolate-reticulate sculpture; supraclypeal area brassy, also with lineolate sculpture, but a little more shining; front dull; antennæ black, the flagellum obscurely reddish beneath apically; mesothorax and scutellum dull, yellowish green; metathorax dark green, the rather large basal area coarsely plicate, with heavy obtuse margin, which is microscopically sculptured all over; tegulæ clear fulvous; wings hyaline, faintly dusky; stigma dark brown, nervures brown, outer recurrent and intercubitus almost obsolete; second cubital cell broader than high; femora black, knees, tibiæ and tarsi bright ferruginous; hind spur as in *H. subcarus;* abdomen very broad, shining black conspicuously but thinly pruinose-pubescent, especially on apical part; hind margins of tergites coppery reddish; surface of tergites microscopically transversely lineolate, and with perhaps a faint metallic cast; venter with much white hair. ♂, Much smaller and more slender, length hardly 3.5 mm., antennæ black, flagellum not very long; no light mark on clypeus; mesothorax dull olive green, scutellum more shining; abdomen narrower.

Queensland (*Williams*). 1 ♀, Halifax, June 20—July 9; 1 ♂, Babinda, April 8-16, 1919.

Female *H. williamsi* is easily known from *H. mundulus* Ckll. by the dark stigma, and from *H. urbanus* Sm. by the color of mesothorax and appearance of the abdomen. The male may be compared with *H. hackeriellus* Ckll., from which it is known at once by the red tibiæ, and dull dark front of head.

Halictus stirlingi Cockerell

2 ♀, Babinda, April 8-16 (*Williams*).

Halictus lanarius Smith

Males, Halifax, July 11 (*Williams*) and Australia (*H. Edwards*).

Halictus blackburni Cockerell

Five females, Halifax, June and July (*Williams*).

Halictus sturti Cockerell

1 ♀, Halifax, June 17 (*Williams*).

Halictus mesembryanthemi Cockerell

♂, Halifax, July 11 (*Williams*); tarsi reddened by cyanide.

A NOTE ON THE PARASITIC BEETLE, *HORNIA MINUTIPENNIS* RILEY[1].

By Phil Rau

Kirkwood, Mo.

In the Ecology of a Clay Bank[2], (p. 236), I have already recorded that the parasitic beetle, *Hornia minutipennis*, was twice taken from the nests of the burrowing bee, *Anthophora abrupta.* Riley has named this species from beetles taken from the nests of this bee (*sponsa*=*abrupta*) collected in this region. Since the publication of the ecology paper, I have gathered a few meagre notes on the habits of this parasite, and since so little is known of its behavior, I beg leave to present them here.

It is well known that the beetle larvæ in the triungulin stage attach themselves to the pubescence of the bees and by this method are transported to the bees' nests, where they feed upon the bee larvæ and attain their maturity.

In 1925, on May 5 and 17, I found one female each time, walking about on the lumps of clay containing the nests of the Anthophora bees, which I had brought into the laboratory. Some time later, June 7, I found on the surface of the clay mass five distinct clusters of triunguli, which apparently had hatched from eggs which I had not noticed. These masses or colonies were separate groups, and the larvæ did not move about at this stage. However, when I came near or brushed them with bits of cotton or dead Anthophora bees, they readily attached themselves to fibers and hairs.

On another occasion a very small hole was discovered in one of the bee cells. Upon opening the cell, an adult female beetle was discovered inside; hence I assumed that the beetle had made the opening. In still another cell, where a hole of the same size was found, I removed a dead mother beetle and hundreds of living triunguli. Another cell which I opened contained a fat female but no eggs or young; an additional cell (found open) contained the shedding skin of the mother and several live triunguli. My first thought was, upon finding the first small opening, that I had discovered the mother in the act of biting her way out. But upon finding in another cell, behind a similar hole, a dead mother and her live young, I began to suspect that the mother beetle does not leave the nest. This would indicate that one or two conditions must obtain; either fertilization must have taken place through the small aperture in the wall of the *Anthophora* cell, or the eggs of the *Hornia* must have hatched without fertilization. My present data are insufficient to give preference to either theory.

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[1] Identified by Mr. E. A. Schwarz.

[2] Trans. Acad. Sci. St. Louis **25**: 236-7, 1926.

I doubt that locomotion by the adult is a factor in their dissemination; their wings are small and useless in flight, their legs are too weak for lengthy walks, and the body too heavy for either type of movement. I have, however, as already stated, seen two adults (in addition to the one recorded in the Ecology paper) slowly lumbering along the clods of earth containing cells of the anthophora bee, but these beetles probably had escaped from clods broken by me for observation.

The colonies of live triunguli discovered on June 7 were placed outdoors on the clay bank, among a weak colony of bees. They were watched for about ten days. During that time, all the colonies held together without any evidence of dissemination. They seemed to get along without food, unless they ate part of their own number, for the bank afforded them no means of subsistence. On June 25, more than two weeks after they had been placed out of doors, the colonies were still intact, although much reduced in size. However, some must have been moving about, for several were found dead in a nearby spider web.

The idea seems prevalent that the eggs hatch in the fall and the young hibernate. In this species, at least, the eggs are laid in the spring. One female, taken from a cell several years ago, laid many eggs in a vial in the spring. This corroborates Riley's statement that the eggs, laid loosely in the burrows of the bees, hatch in June, but our creatures did not substantiate his statement that the young are extremely active.

THE ARRANGEMENT OF THE MAJOR ORDERS OF INSECTS

By C. W. Woodworth

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The relationships of the minor orders have been very frequently discussed, but that of the major orders have been given very scant consideration. The six major orders have been arranged in more than thirty different ways and in the last ten years fifteen authors have used ten different arrangements, half of which had not been employed previously.

The following table gives in chronological order the arrangements that have been used, the initial of the orders Orthoptera, R (Rhynchota) Hemiptera, Coleoptera, Diptera, Hymenoptera, and Lepidoptera, being employed to make a formula for each arrangement. The sign ‡ is used to separate those authors using the same arrangement but in the reverse order.

1735 C O R L H D (Aristotle, Aldrovandus) Linnæus 1735, Geoffroy 1764, Illiger 1798, Latreille 1796, Leach 1817, Lacordaire 1838, Harris 1841, Ruschenberger 1852.

1752 L H R O C D Degeer 1752, Olivier 1789.

1775 C O H L R D Fabricius 1775, 1787, 1792, Lamark 1819, Latreille 1821, Westwood 1839, Carpenter 1858, Gervais and Van Beneden 1859, Staveley 1871, Girard 1873, Le Baron 1874, Thomas 1876, Kirby 1892 ‡ Brumpt 1922.

1798 C O H D L R Clairville 1798.

1805 H C O R L D Cuvier 1805, Hagen 1863, Cook 1889.

1806 C O R H L D Latreille 1806, 1832, Percheron 1835, Snellen von Vollenhoven 1868.

1821 R O D H L C Oken 1821, Redtenbacher 1858.

1823 H C O L D R MacLeay 1823, Stephens 1834, Swainson 1835.
C O H R L D Kirby and Spence 1823, Dumeril 1823, 1860, Rye 1864.

1832 R O D L C H Burmeister 1832. Nicholson 1870, 1871, 1873, Carus 1880, Landois 1905 ‡ Dohner 1862, Sharp 1886.

1841 L D H C O R Newman 1841.

1849 L D R H O C Agassiz 1849 ‡ 1850.

1856 O R C D L H de Hoven 1856, Packard 1869, 1879, 1883, 1886, Kingsley 1884, Orton 1884, O'Kane 1912, Essig 1926 ‡ Packard 1863, Tenney 1865, Fernald 1884.

1864 H D L C R O (Ray) Dana 1864, Leconte and Horn 1883, Howard 1895 ‡ Kellogg and Doane 1915, Comstock 1924, Leonard 1928.

? D R L O H C Figuier.

1881 H C D L R O McLachlan 1881 ‡ Brauer 1885, Comstock 1888, 1895, Kellogg 1905, Folsom 1906, Herrick 1907, 1925, Wellhouse 1926.

1882 O C H R D L Mayer 1882, Shipley and MacBride 1901.

1885 O R D L C H Claus and Sedgwick 1885, Claus 1887, 1891, Blanchard 1890, Lindsey 1895, ‡ Mayet 1890, Riley 1892.
O R D C L H Balfour 1885, Sharp 1886.

1890 O R C L H D Hyatt and Armes 1890, Schiedt 1892, Smith 1897, Sanderson and Jackson 1912, Folsome 1922, Metcalf and Flint 1928.

1895 O C H R D L Hertwig 1895, Hertwig and Kingsley 1902.
O C H L D R Sharp 1895, Handlirsch 1903, 1923, Perrier 1904, Brues and Melander 1915.

1900	O R L H C D	Davenport 1900.
1906	O R C D H L	Woodworth 1906.
1908	O R L C D H	Osborn 1908, Daugherty 1912, Sanderson and Peairs 1917.
	O H C L D R	Froggatt 1908, Lefroy and Howlett 1909.
1920	O R H L D C	Crampton 1920.
1921	O C R L D H	Fernald 1921, Lefroy 1923.
1923	O R H C L D	Martini 1923
1925	O R L C H D	Imms 1925.
1926	O R C H D L	(Swammerdam) Tillyard 1926.

Only three authors had great influence on the arrangement of the orders. *Linnæus* separates those with thickened front wings: probably he also appreciated the coördinated thoracic structure, the large movable prothorax in one group and the consolidated thorax in the other. *Fabricius* combined the three mandibulate orders and the three haustellate, and finally *Oken* grouped together the four orders with complex metamorphosis and within this group the three dominant orders were brought together. He also maintained the proximity of the members of the Linnæan group with consolidated thorax.

These three men all antedated Darwin so that the arrangements in no case expressed any idea of phylogeny, and many later students probably adopted one arrangement or another without seriously considering questions of origin or development. The first evolutionist to suggest a new arrangement was Dana who adopted the sequence used by Ray and the last Tillyard adopted that of Swammerdam. Thus the arrangement that suited the sense of fitness of these great pre-Linnean naturalists corresponds with the ideas of students of phylogeny. Indeed, the general thought has been that the historic groupings, or at least some of them, were essentially natural.

The most decided trend after the days of Darwin has been towards the groupings of Linnæus and Oken and away from that of Fabricius, which had previously dominated, because of the growing conviction that each haustellate order had an independent origin. This and the other trends can be best shown in tabular form, which gives the period during which each proposed arrangement was employed.

BASES OF ORDER GROUPINGS

Thorax	Linnæus 1735-1852
	DeGeer 1752-1789
	Latreille 1806-1868
	Newman 1841
Mouth	Fabricius 1775-1922
	Clairville 1798
	MacLeay 1823-1835
	Kirby and Spence 1823-1864
	Agassiz 1849-1850
	Figuier
	Mayer 1882-1901
	Hertwig 1895-1902
Thorax and Mouth	Cuvier 1805-1889
	Fernald 1921-1923
Thorax, Metamorphosis and Dominance	Oken 1821-1858
	Hyatt and Armes 1890-1928
Metamorphosis and Dominance	Burmeister 1832-1905
	Claus and Sedgwick 1885-1895
	Balfour 1885-1886
	Davenport 1900
	Martini 1923
	Imms 1925
Thorax and Metamorphosis	de Hoven 1856-1926
	Dana 1864-1928
	Woodworth 1906
	Crampton 1920
	Tillyard 1926

Mouth and Metamorphosis	McLachlan 1881-1926 Froggatt 1908 Lafroy and Howlett 1909
Mouth, Metamorphosis, Thorax and Dominance	Sharp 1895-1923
Metamorphosis	Osborn 1908-1917

A conception of high and low development that came with the theory of evolution has had the most profound influence on classification as seen by the fact that only one of the pre-Darwinian arrangements began with the Orthoptera and this order formed one end of the series in every system but one that has been proposed since that period. Entomologists are practically unanimous in placing the Orthoptera lowest, but there is no agreement as to which order is highest, six selecting Hymenoptera, four favor Lepidoptera, the same number Diptera, two Hemiptera, and one Coleoptera. There is a fair degree of agreement regarding which order stands next to Orthoptera, twelve selecting Hemiptera, four Coleoptera, and one Hymenoptera, these latter five being those still clinging to the Fabrician division based on the mouthparts, while the majority favor the division based on metamorphosis following Oken.

There is an agreement among all recent students of phylogeny that each of the six major orders have been derived independently from lower forms, and difference of opinion as to the affinities and arrangement of these hypothetical ancestors explain in large part the diversity of arrangement.

The writer has suggested that a chronological arrangement be followed, since now for a good many years our knowledge of the fossils is adequate to permit of this arrangement. This does not apply to the minor orders in which the palæontological evidence may never be adequate. Handlirsch, who has given very great attention to the fossil insects, has clung to the arrangement of Fabricius, which has required the shifting of the Diptera and Hemiptera beyond the Lepidoptera. Had he set these where they would come naturally according to his palæontological evidence, the arrangement would have been the same as that proposed by me. Tillyard, who has most recently proposed an arrangement, differs from my proposal only in the relative position of Hymenoptera and Diptera, which was based on newly discovered ancient fossils which he identified as hymenopterous, perhaps erroneously. Whether he is right or not, there is abundant evidence in the completeness of the differentiation of the families of Diptera in Tertiary times to establish its seniority to the Hymenoptera. The same kind of evidence makes Lepidoptera the youngest of all.

The chronological order permits the expression of all the accepted genetic relationships with the lower group as acceptably as any other, and is the only basis for the arrangement of the major orders, the adoption of which would result in uniformity. This order is

Orthoptera

Hemiptera

Coleoptera

Diptera

Hymenoptera

Lepidoptera

ÆNICTOMYIA, A NEW MYRMECOPHILOUS PHORID FROM THE PHILIPPINES

BY CHARLES T. BRUES

Among the extensive collections of ants obtained by Dr. J. W. Chapman on the island of Negros in the Philippines are several specimens of a most remarkable species of Phoridæ which he found living with ants of the genus Ænictus. Dr. Chapman has very kindly placed these specimens at my disposal with the suggestion that I describe the species, which proves to be a wholly unknown form, which must form the type of a new subgenus.

In the very recent classification of this family by Schmitz, the new ænictophile falls in the genus Diploneura, which Schmitz has divided into three subgenera, Diploneura *sensu stricto*, Tristœchia and Dohrniphora, but it differs from all of these by a very complete development of the dorsal macrochætæ on the thorax as well as by the excessive length of the bristles on the head and wings.

The following tabular arrangement will indicate the characteristics that serve to distinguish the several subgenera:

1. Hind tibiæ with two dorsal (extensor) lines formed of closely spaced and imbricated bristles, and between these with a series of minute well separated bristles; mesopleuræ bare above.................................2
   Hind tibiæ with only a single row of bristles forming a line of the dorsal surface, mesopleuræ hairy above..3

2. Fourth longitudinal vein sinuous, the base curved upwards and the apex downwards *Diploneura*, s. str.
   Fourth longitudinal vein straight, not distinctly sinuous, nor curved at base of apex...... . ...*Tristœchia*

3. Mesonotum completely bristled; with a median row of four macrochætæ; four achrostichals, three or four dorsocentrals and six marginal scutellar bristles; the macrochætæ all as long or longer than the mesonotum; base of third vein bearing one very long bristle.................................*Ænictomyia,* subgen. nov.

   Mesonotum minutely hairy, without macrochætæ except near lateral and posterior margins; base of third vein bare or with one or two very short bristles *Dohrinphora*

Aenictomyia subgen. nov.

Although clearly related to Dohrniphora, the type of this subgenus exhibits several striking characters. The bristling of the entire body is unusually long as well as the cilia on the costal vein. The very complete and conspicuous chætotaxy of the mesonotum is very unusual, as in practically all Phoridæ the median and anterior macrochætæ are completely suppressed, although those along the posterior and lateral margins are generally more or less well developed. The front is completely bristled; the proboscis geniculate and strongly chitinized; eyes hairy; palpi strongly bristled; cheeks each with three very strong macrochætæ; propleura hairy, with a large macrochæta; mesopleura hairy above; front tibia with a series of four small macrochætæ on dorsal surface; middle tibia with a strong basal pair; hind tibiæ without macrochætæ before apex; fourth wing-vein curved; seventh not distinct.

Type: *Diploneura* (*Ænictomyia*) *chapmani* sp. nov.

Diploneura (Aenictomyia) chapmani sp. nov., Fig. 1.

Female: Length 1.2-1.5 mm.

Yellowish brown, the middle portion of the front, the mesonotum more or less, the tergites of the second and third abdominal segments and the apical one darker brown, the legs lighter, except the hind pair; wings hyaline with the heavy veins light brown. Front wider than long, the surface smooth, impunctate; the upper margin sharp and forming a slightly raised rim except at the sides; two closely approximated supra-antennal bristles directed upwards and backwards; lower transverse frontal row consisting of four equidistant bristles, the lateral ones well removed from the margin of the eye; middle row further from the lower one than from the upper, of four equidistant bristles; upper or ocellar row close to the occipital margin; postocular cilia strong, especially above; cheeks each with three very large and strong bristles; bristles of palpi rather strong and densely placed. Proboscis beyond the basal angle about as long as the head-height, gently curved downwards to the tip. Antennæ small, oval; with a moderately long, weakly pubescent arista. Mesonotum smooth, highly polished, without any microscopic hairs be-

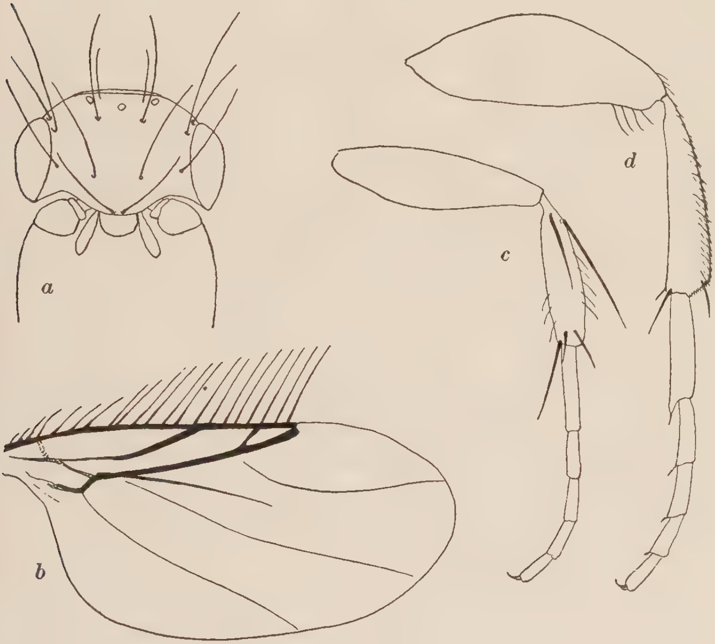

Fig. 1. *Diploneura (Ænictomyia) chapmani* sp. nov.

tween the large macrochætæ; six scutellar bristles, the median ones much further from one another than the others so that there is a group of three on each side, the middle one of which is much longer than either the lateral or median one. Propleura sparsely hairy, with four small bristles at the base of the coxa and a large, erect one at the upper angle; mesopleura sparsely hairy on the upper half. Front tibia with a series of four moderately long bristles on the outer (extensor) edge, one at the basal third, one at middle and two between middle and apex. Middle tibia with a pair of long bristles near base (Fig. 1, c) and two short ones externally at tip. Hind tibia without long bristles. Abdomen very weakly chitinized; with a distinct large dorsal plate on the second and a small transverse plate on the second segment. Wings rather small, costa extending beyond the middle (Fig. 1, b), its cilia very long; third vein forked well before apex; base of third vein with one very long bristle near base; seventh vein not distinct.

Described from three specimens taken by Dr. J. W. Chapman with *Ænictus martini* Forel, at his summer camp in the mountains near Dumaguete, Negros Oriental, Philippine Islands. Dr. Chapman tells me that the Phorids ran along in the foray during the migration of the colony, making faster progress than the ants.

THE DOLICHOPODID GENUS NEMATOPROCTUS LOEW IN NORTH AMERICA

BY M. C. VAN DUZEE

Buffalo, N. Y.

This genus was established in 1857, Neue Beitr., Vol. v, p. 40, for two species. The type designation by D. W. Coquillett, *Chrysotus distendens* Meig. as *Porphyrops annulatus* Macq., the first species mentioned.

Including the three species described here there are thirteen species known, three from Europe, two from Java, one from Africa and six from North America.

The species of this genus differ from those of Argyra by having the first antennal joint bare above, third short, rather rounded, with a nearly basal arista.

Dr. T. Becker places Nematoproctus, Argyra and its subgenus Leucostola in the Diaphorinæ. Dr. J. M. Aldrich includes them in the Rhaphiinæ, to which they seem to me to be much more closely related; we have species of Argyra which are separated from the Porphyrops group of Rhaphium by having from one to three small hairs on upper surface of first antennal joint and the arista not quite apical. Nematoproctus is separated from the subgenus Leucostola by the small third antennal joint with its dorsal arista and the longer hypopygial appendages of the male.

Key to the species of North American Nematoproctus

1. Orbital cilia and the beard yellow; tarsi of male plain (New Jersey) .... *venustus* Melander
   Orbital cilia and beard snow white 2

2. Feet ornamented 3
   Feet plain 4

3. Middle tarsi with last two joints a little flattened and widened (Va., N. Y., Ohio)
terminalis Van Duzee

First joint of fore tarsi fringed with long black hairs on apical half, second joint on whole length (Pennsylvania) .... *junctus* Van Duzee

4. Posterior edge of pleuræ and first three abdominal segments yellow (Connecticut)
flavicoxa new species

Pleuræ wholly black; second and third abdominal segments yellow, at least on the sides 5

5. First and second abdominal segments wholly yellow, except very narrow anterior and posterior margins; hind femora almost wholly yellow (Connecticut)
varicoxa new species

Second and third abdominal segments with yellow on the sides; hind femora black above (Pennsylvania) .... *metallicus* new species

Nematoproctus flavicoxa new species

Male: Length 5 mm.; of wing 4.5 mm. Face nearly as wide as the front, silvery white, its sides parallel; palpi longer than width of face, scarcely half as wide as long, yellow; front green, white pollinose; antennæ black, first joint mostly yellowish, bare above, third joint small, about as long as wide, somewhat conical, arista inserted near the base; occiput green with bronze reflections above the neck; orbital cilia white, a few of the upper cilia black.

Thorax blue-green, dorsum very shining, front slope grayish white pollinose, reddish coppery spots extend along the sides from the suture over the roots of the wing; pleuræ white pollinose, posterior edge yellow; first three abdominal segments yellow, hind margins of these segments narrowly black, the yellow portion shows very slight green reflections; fourth and fifth segments green with coppery reflections at base, sixth violet; venter yellow; dorsum of abdomen and sides beyond second segment with black hair; sides of second with long yellow hair; hypopygium black with numerous bristly hairs on posterior surface, its outer lamellæ black, as long as height of hypopygium, fringed with stiff black hairs on outer edge; no inner appendages visible, except a hair-like one.

Coxæ yellow, anterior pair with rather long, abundant, pale yellow hair and three long and three short black bristles near tip; middle coxæ blackened on outer surface of basal half, their hair pale yellow; posterior ones with one erect bristle on outer surface; all femora and fore and middle tibiæ wholly yellow; basal two thirds of hind tibiæ yellow, spical third black; fore and middle femora with rather short, yellowish hairs below; fore and middle tarsi yellow, becoming blackish towards tip; hind tarsi wholly black; first joint of fore tarsi with a row of longer hairs below, which are shortest at tip and extend along second joint; joints of fore tarsi as 45-16-11-9-9; of middle ones as 57-24-20-11-9; joints of posterior pair as 41-39-26-17-11. Calypters and their cilia whitish; halteres pale yellow.

Wings nearly uniformly tinged with brownish gray; third vein bent backward towards their tips; last section of fourth vein slightly and gradually bent forward from near its middle, then backward so as to be parallel with third at tip, ending in apex of wing; last section of fifth vein straight, it is as 57, cross-vein as 22; sixth vein a little sinuous; anal angle of wing prominent.

Described from one male, taken by C. H. Curran, June 22, 1929, at Avon Old Farms, Avon, Connecticut.

Nematoproctus metallicus new species

Male: Length 3.5 mm.; of wing the same. Face narrow, not half as wide as front, silvery white, its sides parallel; palpi narrow, longer than width of face, yellow, silvery white pollinose; front blue-green, white pollinose; antennæ black, first joint wholly yellowish, bare above, rather long; third joint moderately large, conical, about as long as wide, arista inserted near its base; occiput black, green just back of the vertex, white pollinose; orbital cilia white, only a few of the very small upper cilia black.

Thorax green, dorsum shining, anterior edge dulled with gray pollen; posterior edge of pleuræ black, but seen from behind the space above and between the hind coxæ is yellow; dorsum of abdomen green, three first segments with coppery reflections, fourth and fifth more bluish, sixth wholly blue; sides of second and third segments with large yellow spots; venter of first four segments yellow with a few small yellow hairs, hairs on dorsum black; hypopygium black with only a few short black hairs on posterior surface, outer lamellæ black, narrow, as long as height of hypopygium, fringed with stiff black hairs and a few white ones, inner appendages short, stout, with a few minute hairs.

All coxæ, femora and tibiæ yellow; fore coxæ with a few yellow hairs and two black bristles; tips of hind femora black above; most of apical half of hind tibiæ and whole of their tarsi black; fore and middle femora with short yellow hairs below; fore and middle tarsi black from tip of first joint; first joint of fore tarsi with a row of hairs of nearly equal length below, which are about as long as diameter of joint and continued the whole length of second joint, all joints of fore tarsi with long hairs at tip, above; joints of fore tarsi as 33-14-9-7-7; of middle ones as 40-18-14-7-6; first three joints of hind tarsi as 30-31-18. Calypters and their cilia whitish; halteres pale yellow.

Wings tinged with brownish gray; third vein bent back at tip; last section of fourth vein a little arched, parallel with third at tip, ending just back of apex of wing; last section of fifth vein nearly twice as long as cross-vein; sixth vein a little sinuous; anal angle of wing prominent.

Described from one male, taken by the author, June 4, 1925, in the bed of the old canal, near Amnity Hall, Benvenue, Pennsylvania. Type in the author's collection.

Nematoproctus varicoxa new species

Male: Length 5 mm.; of wing 4 mm. Face rather narrow, a little more than half as wide as the front, silvery white, its sides parallel; palpi yellow, about as long as width of face, with many black hairs, which are nearly as long as the palpi; front blue-green, with white pollen; antennæ black, first joint bare above, a little yellowish below, third small, somewhat conical, as long as wide, arista basal; occiput green, white pollinose; orbital cilia and the beard white, a few of the minute upper cilia black.

Thorax blue-green, dorsum bright, shining with a little white pollen on the front slope; reddish coppery spots on the sides extend from the suture over the root of the wings; pleuræ more black, especially the posterior edge, a little white pruinose; first abdominal segment coppery and green, with long black bristles above; second and third segments yellow, second narrowly black at base and very narrowly on hind margin; third segment with a narrow, sharply defined, white pollinose band at base, followed by a black band of equal width, posterior margin very narrowly black; fourth purplish black on basal half, more green on apical half, fifth colored as the fourth, only more blue posteriorly, sixth segment small, violet; hairs on dorsum of abdomen black, on lower edge of sides of three basal segments long and yellow, above these are a few long black hairs; venter with many long yellow hairs; hypopygium black, posterior surface with about twelve bristles; outer lamellæ black, narrow, about as long as height of hypopygium, fringed on one side with stiff black hairs; two pair of inner appendages, first black, wide at base, tip somewhat knob-like with several minute spines, the other yellowish, hair-like, about half as long.

Fore coxæ wholly pale yellow, with rather long yellow hair, four large black bristles and one small one; middle and hind coxæ black with yellow tips; all femora and tibiæ yellow, hind femora a very little darkened at tip, hind tibiæ blackened from near their middle, extreme tip of middle tibiæ sharply black; fore and middle femora with long yellow hairs on lower surface; fore tibiæ with a row of rather long black hairs on lower posterior edge and a row of about six bristles on upper posterior edge of basal half, which are longer than diameter of tibia; tarsi plain, anterior ones yellow with last three joints blackish, first joint with a row of stiff black hairs below, these are as long as width of joint at base, becoming shorter towards the tip, they are continued on the following joints, long on second, shorter on third and quite short on two last joints; middle tarsi yellowish with tips of first two joints and whole of last three brown; hind tarsi wholly black; joints of fore tarsi as 45-19-12-9-9; of middle ones as 57-20-20-10-10; joints of posterior pair as 37-41-27-16-9. Calypters and their cilia whitish; halteres yellow.

Wings slightly tinged with brownish gray; third vein bent backward at tip; fourth vein scarcely parallel with third except at tip, not but little bent, ending just back of apex of wing; last section of fifth vein as 51, cross-vein as 30; sixth vein sinuous; anal angle of wing prominent.

Described from one male, taken by C. H. Curran, June 25, 1929, at Avon Old Farms, Avon, Connecticut. Type in the American Museum.

The three forms described in this paper are very much alike in the form of fore tarsi, color of wings and form of the long outer hypopygial appendages. *Metallicus* has the abdomen wholly metallic above, tips of hind femora conspicuously black above at tip and third antennal joint a little larger; *flavicoxa* differs from both the others in having the tibiæ and femora wholly yellow, and the posterior margin of pleuræ yellow, it differs from *varicoxa* in having all coxæ yellow, middle tibiæ wholly yellow. They all differ from each other in the form of the palpi, bristles on posterior surface of hypopygium and the inner hypopygial appendages.

THE NESTING HABITS OF THE TWIG-DWELLING BEE, *PROSOPIS MODESTUS* SAY[1]

BY PHIL RAU
Kirkwood, Mo.

The nests of this little bee were always found, in my experience, in the top hollows of sumac twigs. Only the upper part of the cavity was used—usually 2½ or 3 inches, never more. Traces of mud partitions and various other relics in the lower, unused portion made it evident that the tunnels had been used before, but whether this bee always uses old borrowed burrows or whether she may sometimes do her own excavating I cannot say positively. The young of this species construct very thin and transparent, delicate cocoons which entirely cover the body. The cocoons are close together and between them are heavy dividing walls, but I have not yet been able to tell with certainty whether these disc-like walls are actually partitions of waxy substance built by the mother, or whether they are only the front wall or head-piece of each cocoon. These disc-like walls are semi-transparent in the center, and pale yellow, grading to a dark brown color and to greater thickness at the edges. The compact little cocoons, of brittle material which resembles the central portion of the hard disc, are packed in very close together, so close in fact that frequently two adhere to each other.

A good example of most of these characteristics was a little nest which was discovered in a twig in a park in

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[1] Regarding the identity of this species, I quote from a letter from Prof. T. D. A. Cockerell. The bee is "*Prosopis modestus* Say in the sense of Metz (1911). Your male seems to agree with *P. minyra* Lovell (*modestus* var. according to Metz). The female *minyra* has not been distinguished from that of *modestus*. It will be necessary to collect series of your insect to make sure what it should be called, but it is *modestus* in the broad sense."

February, 1920. It was brought home, and during the week of March 25 to 30, four adults of this species emerged. The hollow in the stem was three inches deep, and in this case I could see no evidence that this tunnel had been used previously. The cavity contained eleven cocoons, with no partitions between them excepting the heavy discs described above. The cocoons were crowded so close together that some of them adhered to each other as if built together.

The five lower cocoons contained dead larvæ. Of the six upper ones, four had, at the time of examination, already given forth their adults during the week preceding, and two contained fully developed insects, all black and ready to emerge. Those which had emerged, counting downward from the top, were Nos. 1, 2, 3, and 5, while 4 and 6 were about to come forth. This suggests that the usual order of emergence is from top to bottom of the twig, with occasional exceptions in the case of an individual here and there, due to weakness, sex or some handicap.

Another nest in a sumac twig was found to contain, on April 1, four bees of this species and one parasite. The two lower bees were in a far advanced pupal stage in their cells, while the two upper ones were already making their way out. Each insect had its hard disc above it; above the uppermost one of these was a vestibule of ½ inch, and above this a loose filling, ⅜ inch in depth, of finely broken pith. Here too, the youngest and uppermost was the first to emerge, making it easy for those that were to follow. Her method of emergence was most ingenious. She did not attempt to bite her way through the hard disc forming the partition; that material was too hard, and it was too difficult to get a jaw-hold on the concave surface. So she detoured and bit her way upward through the soft pith in the wall, making a new passage around the side of the obstruction. Don't condemn her for her laziness; respect her for her ingenuity.

The parasite was in the topmost cell. This adult was ½ inch in length, much longer than the host and must have destroyed more than one young of the *P. modestus*.

Up to April 12, three bees had emerged, and the last cell still contained its bee, which was really the eldest of the family (counting from date of oviposition) and was only now completely developed and ready to emerge, the last of the series. The hard disc forming the lid of each of the cells was in no case broken through, but all the insects had bitten out a new channel through the pith and around this lid and thus escaped upward into the gallery. The middle of April terminated the season of emergence of these bees in all the nests which came under my notice.

MUSCID LARVÆ TAKEN IN "SCIARA ARMY WORM"

In the spring of 1929 I observed a mass of fungus-gnat larvæ, usually referred to as a "Sciara army worm" moving across a lawn in Chambersburg, Penna.

With the Sciara larvæ and moving along with them were two Muscid larvæ. When not covered over in the moving mass their white bodies were quite conspicuous in contrast with the darker color of the Sciara larvæ.

I collected both specimens and the adults emerged on July 23rd. They proved to be *Muscina pascuorum Mci.* as determined by Mr. A. B. Champlain of the Penna. Dept. of Agriculture, Harrisburg, Pa. Apparently this species has not hitherto been reported from Pennsylvania, nor has the larva been observed before in America.

J. R. Stear

Chambersberg Laboratory
Penna. Bureau of Plant Industry.

FOSSIL BEETLE ELYTRA

By T. D. A. Cockerell
Boulder, Colorado

Mr. Darlington's remarks in the September Psyche suggest that it may be useful to make a further statement as follows:

(1.) Beetle elytra are of value for stratigraphy, because they are present in many different rocks, and often in considerable numbers. The faunæ are recognizable if well figured, and the species are not too few.

(2.) Fossil elytra are also of value as showing the amount of diversification of these structures in different periods, and especially the antiquity of various characters or structures.

These two reasons seem to me to justify the description and naming of fossil elytra.

(3.) On the other hand, in the majority of cases it is impossible to refer the elytra to definite genera, or in some instances to definite families. Thus a species may be recognizable though its generic position is unknown. In all such cases it seems best to use "blanket-genera," such as *Carabites*, rather than to refer the species to numerous supposedly extinct genera, which cannot be accurately defined.

(4.) It is however probable that when students intensively investigate the elytral structures of modern beetles, many more good generic characters will be found than are now known to exist. If so, it may be possible to return to the fossils, and feel some assurance of their correct position.

PARATENETUS CRINITUS FALL

Sherborn, Mass., has furnished another surprise, or rather several of them, in five or six specimens of what appears to be the above species which was described from New Mexico. At least three of the specimens were taken by sifting. The dates of capture are:—May 11, 1913; May 2, 1915; April 4, 1916; April 9, 1925; November 7, 1926. A specimen was seen in a lot of beetles submitted for determination by Mr. A. P. Morse of Wellesley; this was also taken in Sherborn. This species is easily distinguished by its darker color and the long hairs of the elytra; all my examples are smaller than the general run of specimens of the other species. A specimen was sent to Mr. Fall who states that it appears to be the same as the N. M. type, in spite of the locality.

C. A. Frost, Framingham, Mass.

NOTE ON THE DISTRIBUTION OF TWO SPECIES OF COLEOPTERA[1]

By Elizabeth W. Kingsbury

It seems worth while to place on record the following data concerning two species of Coleoptera. I am indebted to Mr. C. A. Frost for kindly identifying the specimens.

Chrysobothris verdigripennis Frost (Buprestidæ)

This species was described from Maine, and only the original locality is cited in Leng's Catalogue. Mr. Frost has no previous record of its having been found west of Ontario. I captured a female specimen at Buffalo, Wyoming, on July 24, 1929, at an altitude of about 7500 feet.

Uloma punctulata Leconte (Tenebrionidæ)

This species is recorded in Smith's list of New Jersey insects (1910), but the most eastern locality given in Leng's Catalogue is Indiana. On March 26, 1929, I found one individual under the bark of a pine log at Lakehurst, New Jersey, thus confirming Smith's record.

[1] Contributions from the Department of Zoology, Smith College, No. 162.

SOME NOTES AND DESCRIPTIONS OF CERIOIDINE WASP-WAISTED FLIES (SYRPHIDAE, DIPTERA)[1]

F. M. Hull
College Station, Texas

Several interesting studies of this unique group of flies have appeared in recent years. Since their publication I have discovered some new additions to the North American fauna, notes and descriptions of which I am presenting below together with new locality records of other species. I wish to thank Mr. H. J. Reinhard for permission to describe two species collected by him in South and Central Texas.

The strong similarity in appearance between these flies and certain wasps has caused frequent comment. The writer believes this similarity of aspect to be more accurately expressed from a lateral position than a dorsal one. The ever increasing number of discovered Cerioidine forms marks the group as a successful one for the present and one is inclined to wonder if in this case it may not actually be attributed to the mimicry of more aggressive types.

Polybiomyia macquarti Shn.

The Rio Grande Valley seems to be the home of this small slender form. I collected one male at Harlingen, Texas, June 29, 1921, flying about flowering grasses, and one male at Beeville, Texas, August 30, 1928, while resting on a leaf.

Polybiomyia townsendi Snow

One male. Las Cruces, New Mexico, July (F. M. Hull). On greasewood.

Polybiomyia festiva n. sp.

This species is characterized by the reddish color of the thorax and of the face. The markings resemble *P. town-*

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[1] This paper is a contribution from the Plant Lice Laboratory of the Texas Agricultural Experiment Station.

sendi. Where the middle of the second segment of the abdomen in *townsendi* is uniformly red, it is red with a black median stripe in *reinhardi* and the median posterior section is also partially covered with punctate pollen.

Length, 14.5 mm. including antennæ. Female. Vertex yellow, tinged with reddish on every side; front from posterior ocelli to a sharp line just before antennifer reddish, continued narrowly along the median line to antennal prominence and with radiating rugosities in the middle anterior to the ocelli. Antennifer reddish, and this coloration continued from its base as a broad stripe down the face, a narrow one laterally to eye margins, and a stripe on either side of the face. A small black spot on either side of the antennifer above. Lower front and ground color of face yellow. Cheeks red; a black stripe proceeds obliquely from the eye margins two-thirds of the distance to the oral margin. The median red stripe of the face with a broad stripe of microscopic pubescence, thus leaving three slender, shining red stripes. Antennifer half the length of first joint of antennæ. First joint a little shorter than length of second and third combined and a little longer than the second joint alone. Style short. Entire antennæ reddish brown.

Thorax entirely reddish with a short black stripe on either side of the dorsum posteriorly and a shorter, transverse, black dash along the inner ends of the suture, a yellow spot on the humeri, just before the base of wing on mesopleuræ, sternopleuræ, and on the metapleuræ. Scutellum yellow. Halteres reddish. Squamæ pale brown.

Abdomen entirely dark brownish red save for a median black stripe on the posterior third of the second segment and a black tinge on the posterior corners and sides of the same segment. Pollen or pubescence of segments, especially punctate, and together with the lunulate markings quite conspicuous, and extending on to basal half of second segment. Posterior borders of second, third, and fourth segments shining reddish brown. Venter extensively shining black, on the sides reddish. Legs reddish, the sides of the hind femora more deeply and the bases of the tibiæ more yellow. Wings infuscated along anterior margin to tip of wing, the brown coloration reaching completely to spurious vein and bordering the first posterior cell narrowly on its anterior margin. Spur or stigma present. In *P. townsendi* the infuscation does not reach into first basal and first posterior cells.

Type, a female. College Station, Texas, April 4, 1920 (H. J. Reinhard).

Polybiomyia reinhardi n. sp.

This species is allied to *P. bellardi* Shannon. The posterior margin of the abdominal segments are reddish brown, not yellow, and the yellowish coloration of *bellardi* is consistently replaced by reddish brown. Moreover, the wings are infuscated heavily along their entire length to end of costa, the black of the face below antennæ reaches the margins of the eye laterally, etc.

Length about 19 mm. if the entire length from tip of curved abdomen to end of antenna be included. Female. Upper occiput and vertex swollen, tumid, light reddish brown becoming dark brownish red about ocelli and on the sides of the front above. Front brownish yellow on the sides, below with a rounded lobe of black protruding on either side from the middle; middle of front broadly shining black with short silvery pubescence. Face yellow, with a broad wedge-shaped black vertical stripe, extended at right angles just below antennæ in a bifurcate band to eye margins; a lateral oblique black stripe runs from oral margin to eye margin. Vertical median stripe with silvery pubescence medianly and laterally and oblique stripe with a narrow posterior border pubescent. Cheeks and the broad wide lower occiput reddish brown. Entire rim of oral margin black. Antennifer and antennæ reddish brown, the second joint nearly equal in length to the first; third joint half as long as second; style pale, conspicuously silvery pubescent, two-fifths as long as the third joint. Face and lower lateral front unique in bearing many small pimple-like bumps or papillæ bearing short setæ. Entire face and head shining as if varnished.

Thorax shining black with three obscurely indicated pollinose vittæ, one broad median one and a very narrow one on either side. Humeri and a spot before the base of the wing bright yellow. Pleuræ shining black without yellow markings, a brown spot on mesopleuræ, upper pteropleuræ and on the metapleuræ. Scutellum yellow with a narrow brown transverse band. Dorsum papillosetose with a transverse stripe along the suture, not connected medianly.

First abdominal segment dark reddish, with a black spot in the middle above and on either side and with a narrow posterior black border. Second segment black, on the sides and posteriorly dark red, anteriorly yellow; very much constricted. Remaining segments shining black with deep red posterior border and prominent gray pollinose lunules.

Legs shining red, the basal half of all the tibiæ becoming pale yellow, and the femora basally, paler in color. Halteres and squamæ brownish yellow. Wings dark brown on the whole anterior half the infuscation, reaching to the tip of wing or end of costa.

Type, female and three paratypes, females, Dilley, Texas, May 4-11, 1920 (H. J. Reinhard).

This interesting form is certainly related to *bellardi* in the pattern of the pleuræ, thorax, and abdomen. However, the several specimens of this species differ from that species in a number of points. Among them are the face with its papillosetæ and its peculiar bulges, and the ventral concavity of the abdomen with the unusual shape of the last two abdominal segments. Structurally it would appear nearest related to *schwarzi* Shnn. The shining, glossy black of *schwarzi* Shnn. renders that species abundantly distinct.

NOTES ON THE PREY OF WASPS

By Richard Dow

The first three records are based on specimens in the collection of Dr. J. Bequaert, who has kindly permitted me to publish on his material. I am also indebted to Prof. N. Banks, Mr. C. W. Johnson, and Mr. Wm. T. Davis for assistance in determining specimens.

Ageniella accepta (Cress.)

Lycosa sp., immature [N. Banks]
Riverhead, L. I., N. Y.; Aug. 1, 1917; Wm. T. Davis

It is customary for the species of Ageniella and Pseudagenia to mutilate their spiders by removing the legs. The present spider forms no exception, as all eight legs have been nipped off at the coxæ. According to Hartman (Bull. Univ. Texas 65:47. 1905), this Psammocharid also preys on Attids.

Crabro (Thyreopus) argus Pack.

Rhaphium vanduzeei Curran [C. W. Johnson]
White Plains, N. Y.; Sept. 10, 1921

This is apparently the first reference to the prey of the above wasp. The fly has been described since the compilation of the New York list.

Tachytes mandibularis Patt.

Conocephalus saltans (Scud.) [Wm. T. Davis]
White Plains, N. Y.; Sept. 10, 1921

Orchelimum fidicinium Rehn & Hebard [Wm. T. Davis]
Oyster Bay, L. I., N. Y.; Aug. 31, 1929

In the case of the second record, the wasp was flying with the Orchelimum, and both were caught in one sweep of the net. The wasp was killed, but the grasshopper was brought back to the laboratory for observation. Two days later it was still alive, and when stimulated, moved the abdomen, the antennæ, and both pairs of palpi. That evening and also the next morning, it was moving the antennæ and palpi spontaneously. The following morning (Sept. 4), it was dead.

When Patton described *T. mandibularis* (Ent. News 3:90. 1892), he gave the prey as Xiphidium (now Conocephalus). F. X. Williams found it preying on an immature Orchelimum (Kans. Univ. Sci. Bull. 8:198, 1913), and Wm. T. Davis has an additional record for *Orchelimum fidicinium* in the New York list (p. 23).

SOME NEW NEOTROPICAL NEUROPTEROID INSECTS

By Nathan Banks
Museum of Comparative Zoölogy, Cambridge, Mass.

The following new species from the collection of the Museum of Comparative Zoölogy are mostly from Cuba and chiefly obtained in the past few years.

Psocidæ

Compsocus gen. nov.

Belongs to the Amphientominæ. Head moderately broad, bent down, clypeus fairly large, ocelli present, legs rather short, hind pair longer, tarsi of three joints, femora rather swollen, on hind tibia only a few spines on lower apical half. In hind wings the media is forked, and the axillary separate from anal. In fore wings the subcosta is long, curved, and ends in radius, forming a long cell; but one axillary vein, but this plainly forked toward base, axillary and anal end together; radius forked once, media twice; the cubital fork is near to margin and so almost forms an areola postica; surface of wing with many minute, short scales, some stout and rounded at tip, others longer and forked at tip, each kind in separate patches.

Compsocus elegans sp, nov.

Figure 4.

Black; antennæ very fine and thin; legs black, tarsi pale, hind basitarsus with dark band near middle. Wings black, with three hyaline white spots along hind margin, one at end of anal, one over lower branch of cubitus, and one over end of upper cubitus and reaching up to radial branch. On the surface of wing about 12 large silvery white spots; about five tending to form a row across near end of stigma, one of which is in end of stigma and extends beyond to next vein, one in the base of radial fork, two behind it, and one in the median fork; about middle of length are two more silvery spots, and before this an interrupted band from costa just beyond subcostal cell, and extending across radius, and two spots nearer to base; hind wings fumose, veins darker. In fore wings the short, rounded scales are in pale areas, the forked scales densely placed to form dark areas. Both wings iridescent.

Length 2.2 mm.

From Barro Colorado Island, Panama, 23 June. A remarkably beautiful species.

Hemipsocus pretiosus sp. nov.

Figure 5.

Head dull yellowish, unmarked; antennæ also, likewise the thorax, abdomen blackish above, femora dark, tibia and tarsi pale; head, thorax and antennæ with moderately long, pale hair. Fore wings mostly brown; veins nearly black, the longitudinal veins with white spots, particularly prominent beyond the middle; two larger white spots on posterior margin just beyond the end of the cubital vein; veins with erect hairs arising from black spots; the vein bounding areola postica and the cross-vein above it are hyaline-white; hind wings grayish hyaline. Wings shorter than in *H. roseus*, but the venation is very similar, the fork of the median vein, however, reaches back to the cross-vein to areola postica or even onto the cross-vein.

Length of fore wing 2.2 mm.

One from Soledad, Cuba, 18 February (Myers) and the other from Royal Palm Park, Florida (Blatchley).

Thyrsopsocus pretiosus sp. nov.

Figure 3.

Head, thorax, and abdomen black, a pale V-mark on thoracic notum in front. Antennæ brown or black, with black hair on third joint, basal joints and base of four joint pale; legs black or brown, paler on apical part of tibia and basitarsus, middle tibia whole pale. Wings hyaline, with a large black spot occupying most of apical part as in the figure, containing three large pale areas; in front, one each side of the stigma, and one over most of the posterior cells; stigma dark at each end and behind to radius, yellowish through the middle; on basal part of wing two transverse black spots, and a longer oblique one above and into part of the cell. Veins dark, but end of discal cell and lower part of outer side, and the forking of radius yellow; hind wings hyaline, with dark veins.

Length of fore wing 6 mm.

From Barro Colorado, Panama, 18, 23 July.

Thyrsopsocus bellulus sp. nov.

Figure 1.

Head pale yellowish brown; antennæ black, with black hair, basal two joints pale yellowish; thoracic notum pale, a dark band across connecting bases of fore wings; scutellum dark, with pale margin; abdomen dark above, near tip is a large yellowish spot each side, venter pale; legs pale, tips of tarsi dark. Wings hyaline, with mostly pale brown marks in apical part of wing as figured; the stigma yellow and the yellow extended back to radius; black marks at base of stigma, on each side along connection to radius, and in the posterior edge of cell, and two transverse marks in basal part of wing, the hinder one curved and extending toward base; veins mostly dark brown, the basal part of radius and some of media yellow, also most of stigmal vein; hind-wings hyaline, with dark veins.

Length of fore wing 6 mm.

From Carmelina, Honduras, March, on orange (W. M. Mann).

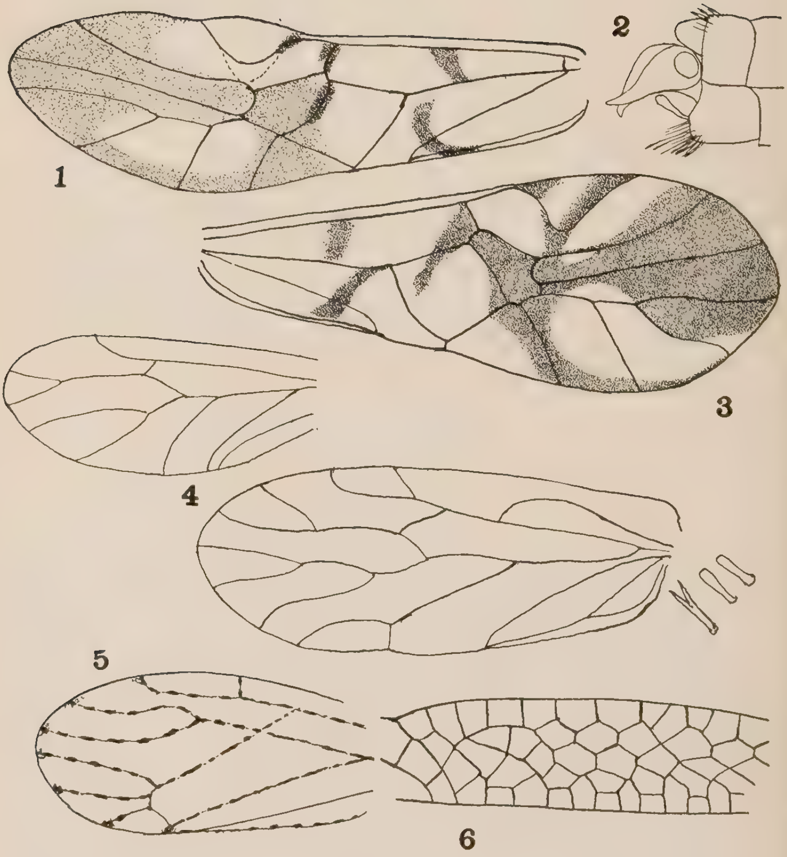

PLATE 9

Banks—Neuropteroid Insects

Ephemeridæ

Callibaetis completa sp. nov.

♀ Body of the usual pale brownish, with many small dark dots, especially on the abdomen, beneath with larger, paired dots, above on abdomen the basal segments show a large dark spot in middle, tending to form a stripe; second joint of antennæ mostly dark brown; legs pale, the tarsal joints faintly dark at endings. Wings hyaline, a broad brown stripe along front margin, covering the first three veins, and on base a little more; this brown fills the costal area to base, and also at tip, it contains a number of transverse hyaline white marks, mostly over veins, very few of these pale spots in the apical fourth, behind the brown is fairly even. The veins are brown, and cross-veins also; there are a few cross-veins near tip, about eleven in a curved series from middle back to near base, before middle near middle of length are three cross-veins, and toward base three more.

Length fore wing 7.5 mm.

From Soledad, Cuba, 20 June (G. Salt).

Hemerobiidae

Hemerobius cubanus sp. nov.

Head brownish yellow, no distinct marks; antennæ similar, but paler toward tips; thorax also similar, with long pale hair above; abdomen darker brown; legs pale, the tibiæ (especially of second and third pairs) swollen toward tip, the hind ones with a dark line on the hind edge of the swollen part.

Wings nearly hyaline, or faintly fumose; veins brown and pale in spots, and brown at origins, and from the brown spots are often extensions of brown out on the membrane; the gradates dark brown, and bordered with brown; stigma not distinct; the brown marks are closer and more distinct in the posterior basal part of wing; hind wing with some brown near tip over the cross-veins and also near base over the branches from anal vein. Wings about of shape of *H.*

humuli, the costal area toward base a little broader; three branches to the radial sector, the last soon forked and again before the connection back to radius; about five inner and seven outer gradates, outer ones partly between forks, inner ones somewhat in pairs, the hind pair nearly interstitial.

Fore wing 6.5 mm. long.

From Pico Turquino, Cuba, 5000 ft., 20 July; and Sierra Maestra, Cuba, 1100-1300 ft., 10-20 July, both collected by C. S. Bruner and C. H. Ballou.

Megalomus cubanus sp. nov.

Figure 2.

Head dull yellowish; antennæ pale brownish, basal joint yellowish; pronotum with about six or eight brown spots, rest of notum also largely dark; abdomen yellowish, as also legs. Wings faintly smoky, with yellowish venation, marked with black along the margin, groups of two or three dark dots; the gradates and an oblique streak up from end of anal nearly black, a brown spot at extreme base of wing, and often small dark dots at forking of veins; just beyond the first gradates there is a narrow pale stripe across wings; hind wing with dark before stigma, the basal part of radial sector and some apical dots dark. Costal area as wide as head plus the pronotum; five radial sectors, the fifth forked at first gradates and upper branch forked again before the second gradates. The median forked just before origin of second radial sector, cubital forked before first gradates.

Expanse 13 mm.

From Soledad, Cuba, 6 March (J. E. Myers).

Has appearance of *M. minor,* but gradates not as oblique as in that species.

Coniopterygidæ

Coniopteryx marginalis sp. nov.

Head yellowish brown; antennæ pale yellowish, legs also, a faint dark mark at tip of femur; mesonotum brown, with a rounded dark brown spot each side near base of wing, pleura nearly black; abdomen pale, dark at tip. Wings fumose, veins darker, most of the cross-veins bordered with hyaline white; along the outer and hind margin are about six dark spots, each between ends of veins; the nearest base is a large one just before the end of cubitus, the next a very small one just beyond the cubitus, then three large spots, in median fork, between media and radius, and in fork of radial sector, and then a small one just above end of radial sector. Hind wings unmarked; both wings mealy white. General shape and venation practically as figured for *C. nivosa* Enderlein.

Length 3 mm.

From Sierra Maestra, Cuba, July 10-20, 1070 to 1350 ft.. C. S. Bruner and C. H. Ballou.

Myrmeleonidæ

Myrmeleon wrighti sp. nov.

Figure 6.

Head mostly black; lower face toward mouth, and the sides toward eyes pale; palpi and antennæ mostly black. Pronotum dull black, a trace of a pale median line in front, and the lateral margins narrowly pale, and a faint pale mark each side behind; rest of notum dark; pleura mostly dark. Femora black in apical half, middle femora almost wholly black, front and mid tibiæ with sub-basal and apical black marks, hind tibiæ black beneath and at tip; tarsi almost wholly black, bases of first and fifth joints only pale; bristles black. Abdomen dull black, a little pale each side at tip; hair short, black above, white below. Wings unmarked; venation interruptedly black and white; stigma pale.

Pronotum much broader than long; first tarsal joint about one-half of fifth; spurs about equal to first joint. In the fore wing seven cross-veins before radial sector, in hind wings four, the first very oblique, about eight branches of the radial sector; in hind wing three or four branches of first anal vein; in fore wing about twelve connections between radial sector and radius before the stigma.

In fore wing (and also in hind pair) there is no definite line in cubital area parallel to cubitus as is present in nearly all species; there is the usual curved beginning of such a line, but it soon runs into the center of a series of diamond-shaped cells.

Length fore wing 34 mm., width 7.3 mm.; length hind wing 30 mm., width 6 mm.

From Cuba (Chas. Wright).

Readily separated from the common Cuban *M. insertus* by larger size, as well as peculiar structure of cubital area.

Austroleon garciana sp. nov.

Head pale, a large dark interantennal mark reaching up to vertex, a narrow dark band across above clypeus, last joint of palpi marked with dark, vertex with two conjoined dark spots above, each enclosing a pale spot behind, antennæ dark, faintly annulate with pale. Pronotum pale, two rounded dark spots in front, two streaks behind and a lateral dark stripe, margin with some long, curved, white bristles; meso- and metanotum much marked with dark, the scutelli with a median dark spot, pleura brown, with several pale spots, legs pale, dotted and spotted with brown, third and fourth tarsal joints almost wholly black, front coxa with several curved white macrochætæ, also a row above on the front femur; spurs equal to two tarsal joints. Abdomen dark, several segments show one or two pale spots or streaks each side above, hair above black on basal part, paler toward tip, venter with white hair.

Wings hyaline, veins dark, with pale spots, a rather distinct spot at the rhegma, radial sector in the hind wings almost wholly dark. Wings slender, much more so than in

A. cubitalis Navas; venation generally similar to that species, two or three cross-veins in hind wings before radial sector, three in fore wings, about five branches to radial sector. The hind wing is so slender that the branches of cubitus are nearly simple, only a few forked and no cross-veins between them as in *A. cubitalis;* the marginal hair is shorter than in *cubitalis.* Fore wing, length 16-18 mm., width 3.5-4 mm. Hind wing, length 15-17 mm., width 2.5-3 mm. Abdomen 16-18 mm. long.

From S. Barbara, 15 March, and N. Gerona, 1 March, Isle of Pines, Cuba, both by C. S. Bruner.

Differs from *cubitalis* Navas not only in smaller size, more slender wing, but also in pronotal marks, *cubitalis* having a single median mark behind; the spots on vertex also different. Both specimens lack the spots along cubitus seen in *cubitalis.*

EXPLANATION OF PLATE 9

Fig. 1. *Thyrsopsocus bellulus,* fore wing.

Fig. 2. *Megalomus cubanus,* male genitalia.

Fig. 3. *Thyrsopsocus pretiosus,* fore wing.

Fig. 4. *Compsocus elegans,* hind and front wings and scales.

Fig. 5. *Hemipsocus pretiosus,* front wing.

Fig. 6. *Myrmeleon wrighti,* cubital area of wing.

PROCEEDINGS OF THE CAMBRIDGE ENTOMOLOGICAL CLUB

Ten meetings were held in 1929, including one special meeting in September. The programs were as follows: Jan. 8, Dr. J. Bequaert, "Notes on Masarid Wasps." Feb. 12, Prof. W. J. Crozier, "The Behavior of Arthropods." March 12, Prof. N. Banks, "Secondary Sexual Characters in Insects." April 9, Prof. W. M. Wheeler, "The Identity of the Ant Genera Gesomyrmex and Dimorphomyrmex"; Mr. C. W. Johnson, "Notes on Some Hippoboscidae." May 14, Prof. C. T. Brues, "An Entomological Excursion to the Hot Springs of the Southwestern United States." June 11, Dr. L. R. Cleveland, "Some Studies on Termites and their Intestinal Protozoa, with Special Reference to the Symbiotic Relationship between Certain Termites and their Protozoa." Sept. 10, Summer Collecting Notes. Oct. 8, Prof. C. T. Brues, "Notes on the Insect Fauna of a Pine Forest"; Mr. P. J. Darlington, "Collecting Notes on Florida Beetles"; Dr. F. M. Carpenter, "Phytophagous Larvæ in the Palæozoic." Nov. 12, Prof. W. M. Wheeler, "A History of Our Knowledge of the Ant Lions." Dec. 10, Mr. C. W. Johnson, "Some Notes on the Insects of Nantucket."

Following a motion passed at the October meeting, the November and December meetings of the club were held in the Peabody Museum, Cambridge. The November meeting was the first to be held in Cambridge since March, 1903.

Two new members were elected in December, making the total membership ninety-one.

RICHARD DOW, *Secretary.*

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A regular meeting of the Club is held on the second Tuesday of each month (July, August and September excepted) at 7.45 p. m. in Room J, basement of the Peabody Museum, Divinity Ave., Cambridge. Entomologists visiting Boston are cordially invited to attend.

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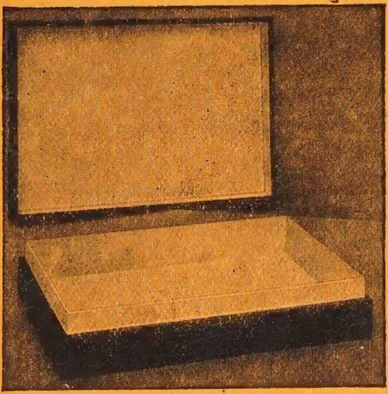

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